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ORIGINAL ARTICLES

PHOTOGRAPHY FOR ORTHODONTISTS*

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INTRODUCTION

THE laity regards distortion of the facial lines as a cardinal symptom of abnormal dentition; not infrequently, it is the only consideration which impels a patient (or parent) to seek orthodontic treatment. Though the relative frequency of such facial modifications is not definitely established and their etiology is not well understood, orthodontic treatment is accepted as a corrective measure of very great value.

Some of the very earliest contributions to dental literature contain illustrations portraying various kinds of facial malformation, and the custom of keeping some form of record (at least of extreme distortions) has become well-nigh universal. The introduction of plaster of Paris by Pfaff (1756) as an impression material for reproducing the human denture, led to the development of a technic for constructing facial masks. The late Dr. C. S. Case used the latter method quite extensively. In 1915, Dr. J. A. W. van Loon perfected it, so that one can determine the relation of the teeth to the head.

Time will not permit consideration of the various methods which have been employed for recording dentofacial deformities. Moreover, photographic procedures are so widely accepted and a description of the essentials of this method forms a subject of such ample size, that the writer will restrict the following lines to this theme.

Furthermore, the value of any method depends upon its usefulness in

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diagnosis; and all of the other methods (at least in their present state of development) are less useful in this important respect than photostatics.

I. HISTORY

Photography has been called "a child of optics and chemistry" and was first presented in practical form through the French Academy of Science in 1839. It was then known as the "Daguerreotype Process," being named after its inventor, Jacques Daguerre. Henry Fox Talbot, of England, immediately recommended improvements, but both were skeptical about its application in portraiture. The time of exposure necessary to secure an image ranged from twenty-five to thirty-five minutes, hence their skepticism was justified. "It remained for Professor John W. Draper, of the University of New York, to shorten the time to as many seconds." This very great achievement occurred in the same year (1839), a year of unusual significance in many ways for dentistry. "Samuel F. B. Morse, the inventor of the telegraph, was associated with Professor Draper in his early photographic experiments. To them belongs the distinction of making photography available for commercial purposes and of making the first portrait from life by photography."

The rapid development of photography during the last fifty years is well known and the many technical improvements in cameras, lenses, plates and films, print-paper, etc., need not be related here. The "Self-Instructing Library of Practical Photography," edited by Schriever and Cummings and published by the American School of Art and Photography (Scranton, Pa., 1908), and "The Photo-Miniature," a monthly magazine, published by Tennant and Ward, of London and New York, provide an excellent, comprehensive and practical library of the art.

II. ORTHODONTIC USES OF PHOTOGRAPHY

When orthodontics became a specialty (1896) the number of devoted investigators of its many problems was considerably increased, and the literature since that time shows a corresponding increase in illustrations pertaining to facial malformation and its correction by orthodontic methods.

For a score of years, following the beginning of the era of specialization in orthodontics, we regarded facial modifications as troublesome complications and their correction as a desirable incidental achievement. We failed to study them in a thorough manner, though this is clearly one of our duties.

In 1916, Dr. Frank A. Delabarre read a paper before the American Academy of Dental Science, of Boston, entitled: "Photography as Applied to Orthodontia," in which he said:

"The need for some system is evident, for orthodontic literature is sprinkled with photographs, no two pictures of which, even of the same case, are taken to the same scale or under similar conditions. Consequently, comparative study of them is of small value, because it is always warped or distorted by the accidentals and variations in scale, pose, focus, lighting, etc. It is possible, however, by standardizing methods, to eliminate these accidentals and variations and produce photographs that can be accurately compared

and measured, so far as measurements can be applied to photographs of other than flat objects."

"The standardization should apply to both equipment and method; the latter to embrace uniform methods of posing, lighting, focusing to a definite scale, printing, the use of a screen to aid the study of symmetry and growth; also the acceptance of definite anatomic landmarks as guides to the various steps."

This essay by Delabarre is full of valuable suggestions and he stood on the threshold of the photostatic method, elaborated by Dr. Paul W. Simon, and to which I will refer later.

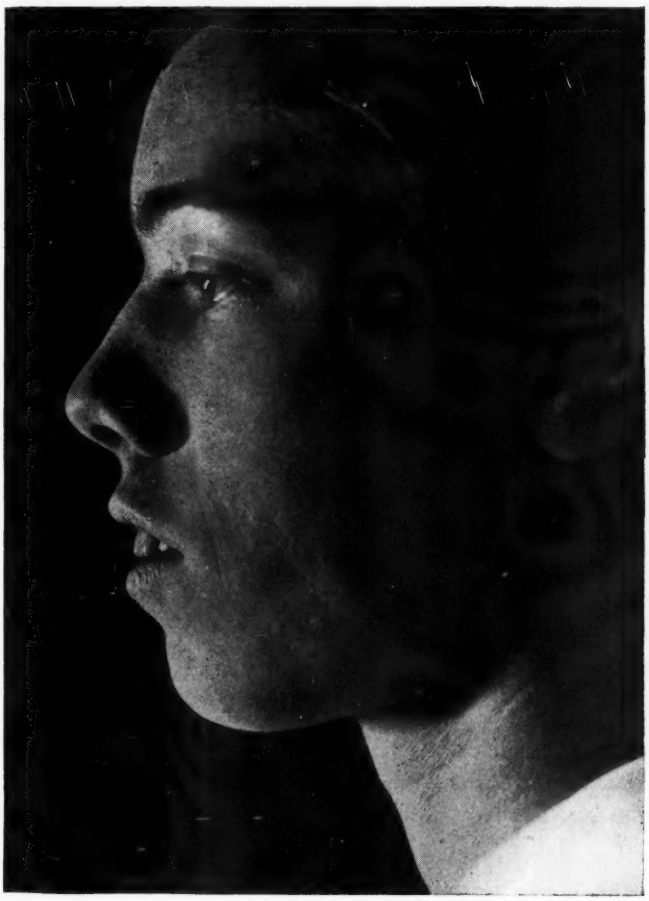

Fig. 1.—Natural size profile, the left margin of which is perpendicular to the plane of the head. (Reduced one-half for publication.)

In the *International Journal of Orthodontia,* for 1916, the writer presented a series of articles entitled: "Face Facts," in which he urged orthodontists to make a scientific study of the facial modifications met with in practice. This was followed by another article in 1919 (ibid.) entitled: "Variations and Modifications of the Facial Features." A still later article (1924) "On New Methods of Diagnosing Dentofacial Deformities" again emphasized the importance of photography as an aid in diagnostic procedures.

During the last fifteen years, the writer has used numerous kinds of

lenses, cameras, plates, chemicals and print-papers, and discarded nearly all of them. Every time a new equipment was purchased his expectations were revived. Finally, an 8 × 10 studio-camera with special long bellows and equipped with a Goerz "Celor" lens, No. 8 (19-inch focus) was installed. The taking of full-front, left-profile, and of three-quarter views, all of exact life size, for all patients, became a fixed routine in the office, after the problem of artificial lighting was solved. Thus, all went well; and under the spell of these alluring anticipations important disclosures seemed daily to be "just around the corner." This equipment requires a floor space 8 × 12 feet.

The bellows of the camera was marked for exact position on its bed, by photographing a ruler and comparing the results with the original, to deter-

Fig. 2.—Natural size tracings on semitransparent, millimeter, cross-section paper traced from profile negatives. (Reduced one-half for publication.)

mine the relative accuracy of the method. Thus, half and life-size positions were soon determined and either size could readily be employed by again adjusting the camera to either of these marks, resulting in profiles which were fairly true to scale.

Following the suggestions by Delabarre, anatomic landmarks like the orbitale, tragion, subnasion and subaurale were marked, and the margins of the prints were permanently scratched on the negatives at right angles to a horizontal plane. The printing matts were always placed in the same uniform manner and the margins of the finished pictures thus became standardized. (Fig. 1.) Profile negatives were also placed on an illuminated field and the profile outline traced on semitransparent cross-section paper. (Fig. 2.) This

method yielded graphical tracings which recorded deviations in two dimensions, i.e., facial length and height. Extreme distortions were also rendered mathematically comprehensible and suggested the feasibility of further study of individual and group characters in conjunction with tracings of normal individuals of the same age and sex.

Extensive clinical observations convinced the writer that many dentofacial deformities presented complicated deviations of form of the supporting jaws, so that the widely used phrase "malocclusion of the teeth" became hopelessly inadequate for expressing their true nature. In other words, the aim of all these efforts was greater accuracy in diagnosis, a more intelligent understanding of dental anomalies, a stricter objectivity. The miscellaneous pictures provided by various portrait photographers had previously been discarded as worthless; but a method for demonstrating the natural relationships between the teeth and head, with the aid of photographs of a patient's face and his dental casts, forever eluded him.

But a practical orientation of these two parts of a record of a given case

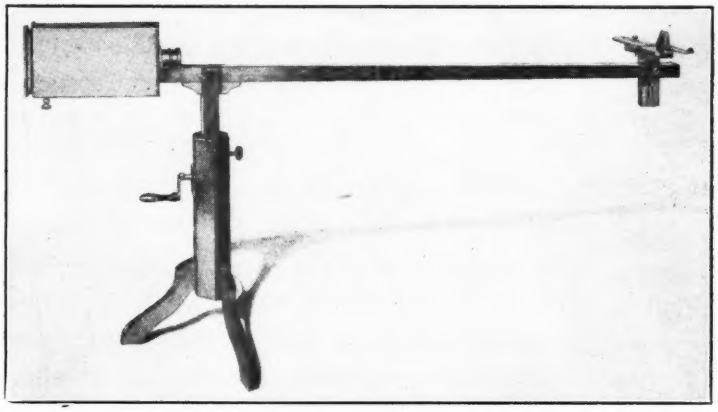

Fig. 3.—Simon's photostatic camera.

is the essential, or pivotal, point of the whole matter, because the cranial relations of the jaws are not shown on dental casts and the occlusal relations of the teeth are not revealed on facial photographs.

The methods of Van Loon referred to above, presented an anthropologic approach to these orthodontic problems of diagnosis and were the incentive for Simon to undertake his gnathostatic investigations.

Gnathostatic casts of a denture made according to Simon's method permit one to accurately measure the relation of the teeth to three planes of the head, and his photostatic photographs supplement and substantiate the gnathostatic diagnoses.

The equipment designed and recommended by Simon is entirely adequate for procuring profile pictures for diagnostic purposes which fulfill all the necessary scientific requirements (Fig. 3).

"Photographs are perspective, not geometric, projections; they originate from rays which cross each other in the center of the lens. This fact may be regarded as an objection to the metric value of photographic reproductions,

because the various points and individual parts of an object are thus projected with varying degrees of angularity; those farthest removed from the lens appear smaller, whereas points nearer to the lens appear larger. But this error diminishes with increasing distance between the object and objective." (Simon.)

Simon devised a unique experiment for computing the degree of error in a perspective reproduction, which shows that this error (if kept within certain bounds) is of no consequence in our work. He also reminds us that an orthogonal, or geometric, projection of a profile does not yield a more accurate presentation of the depth of an object like the human head. In other words, in a geometric projection of a face one cannot determine the natural distance between the gonion and the median plane. Computations in the third dimension are thus excluded in either method.

Profile pictures made according to Simon's method are one-quarter natural size and all photographs of the same individual (taken at various intervals) and of different individuals are taken under the same exact conditions.

"This is accomplished because (a) the median plane of each head is always the same distance from the lens, (b) the median plane of the head and the photographic plate, or film, are parallel to each other, and finally, (c) the line of the lens-axis passes through both orbital points." (Simon.)

III. PRACTICAL COORDINATION OF DENTAL CASTS AND FACIAL PHOTOGRAPHS FOR ORTHODONTIC-DIAGNOSTIC PURPOSES

A floor space of 5 × 10 feet will accommodate a photostatic apparatus. It should be kept in readiness for use at all times, like a Roentgen ray equipment. There is one important difference to be noted in their use: in radiography the equipment is brought towards the patient, whereas in photostatics the patient is moved toward the equipment.

The camera is of a box-type and after it is adjusted for use, the "bellows" remains fixed. It is mounted on a stand of studio pattern, which provides the necessary stability. It is also provided with a beam to which a nose-board is attached. The latter is accurately fixed in position with the aid of a median scale 4 cm. long and two half-round red discs. The nose-board renders possible the accurate posing of the head. The camera, beam and nose-board are adjustable to any height.

The lens is of the portrait-type, with double objective and long focal distance (25 cm.).

"Before using the nose-board, its orbital edge must be accurately placed in the lens-axis. To do this, we proceed as follows: the ground glass is removed from the camera and with a ruler and a sharp lead pencil we draw two diagonals on its inner (rough) surface. Their point of intersection will lie in the lens-axis. The ground glass is again inserted in the camera, the light is thrown on the scale or nose-aimer and the bellows is moved back and forth until a sharp image of the median scale on the nose-aimer is procured. The nose-board is still in temporary position, however; but very little effort

is required to bring it into exact place, because it can be turned or moved in any required direction. The adjustment is finally concluded when the image of the half-round, red discs forms a complete circle and the outer end of their horizontal diameter (that is, the line of union of the two discs) lies in the center, or point of intersection of the diagonals, of the ground glass'' (Fig. 4).

''The bellows of the camera is then adjusted until the image of the 4 cm. 'median scale' is sharp and measures 1 cm. in length, after which all screws are securely fastened. The apparatus is now ready for use and a glance at the image of the red discs will always disclose whether any alterations occurred between the various appointments.'' (Simon.)

A light, simple dining chair, provided with ball-bearing casters, so that it may be pushed about without difficulty, should be used for seating the patient. A headrest can be attached to this chair and after the patient is seated and the headrest is adjusted, they are moved towards the apparatus.

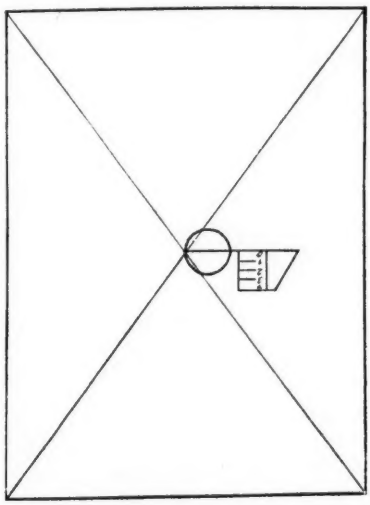

Fig. 4.—Diagram of the image on the ground-glass of the half-round discs and median scale of Simon's nose-board; the edge of the nose-board is in the central axis of the lens and appears inverted.

But prior to seating the patient, it is well to turn on the light, glance at the image of the median scale and discs, to note if they have been tampered with, insert the plate-holder, cover the lens, remove the safety-slide from the film-holder and exclude any unnecessary glaring daylight by drawing the window shades. A properly trained assistant can do all of this.

Thus, after all is in readiness, the operator brings in the patient, adjusts the headrest and pushes the chair towards the nose-board until they are very close to each other. The height of the board is then adjusted by raising or lowering the camera. The operator then steps in front of the patient and sights the aimer, so that the median plane of the head is in proper alignment; then gently draws the patient towards him until both eye points touch the orbital edge of the nose-board. The board is then turned back and the patient is instructed not to move. An exposure of two seconds, by removing the lens-cap, will usually suffice.

A 100 to 300 candle-power light mounted on an adjustable stand, and provided with a reflector and piece of frosted glass to relieve the glare, is ample for lighting purposes.

A yard or two of black felt cloth, dropped in window shade fashion about 2 or 3 feet behind the patient's head, forms a good background and provides the necessary "atmosphere." A dark, one-tone background, without ornamentation, is best.

In my work at the chair, I have found it convenient to make a special appointment for taking the gnathostatic impressions of the teeth and photostatic exposure for the photographs. Both require marking of the following points on the face: 2 orbitalia, 2 tragia and the gonion. These are best

Fig. 5.—A one-fourth natural size photostatic print showing the *orbitale* (eye-point), the *tragion* (ear-point) and the *gonion* (mandibular-angle-point). The median plane of the head was parallel with the plate in the camera and the orbitale is the central point of the print, which measures 6 x 9 cm.

located with the aid of a dermatrograph and more visibly marked with small pieces of black adhesive paper about 2 or 3 mm. square. After these are in position, it is advisable to take the picture and follow this with the impression, because the latter may cause some disturbance of the facial muscles.

The orbital points used for this purpose are cephalometric points and are not the craniometric points used by craniologists. The left orbital and ear-points, as well as the left gonion, will show in the negative and on prints made therefrom (Fig. 5). These can be connected by lines and thus permit us to draw the horizontal and orbital planes on the negatives, or prints. Lines can also be drawn from the gonion to the gnathion, and to the tragion,

and the mandibular angle and the length of the body and ramus of the mandible can thus be demonstrated. Of course, these are only approximations; but since they are always drawn in the same accurate manner, they are sufficiently exact and are the best available means for diagnostic purposes (Fig. 6).

In females, the hair must be arranged behind the left ear, so that the tragion is exposed to view. In children of a "nervous type," an assistant may be required to hold the patient's head firmly in position. The assistant's hand should be so placed that it will not show in the picture. Fortunately, this is seldom necessary, because most of them are glad "to have their pictures taken."

Fig. 6.—The facial points have been connected with lines for diagnostic purposes.

"The entire photostatic procedure is no hardship to the patient and seldom requires more than two to three minutes. Neither is it difficult for the practitioner, if he will familiarize himself with the method. For this reason it is preferable to all other methods for reproducing the facial contour."

"The development of negatives and prints can be entrusted to a photographic supply house; but since it offers no special difficulties, an assistant may be trained to undertake these minor details."

"The photographic method occupies first place in so far as accuracy of reproduction is concerned. Martin expresses himself as follows: 'Only such measurements yield useful results which can be applied uniformly by observers after preliminary training; and experience has taught us that we

must relinquish as little as possible to personal initiative and interpretation.' "

"Photostatic reproductions offer the best conceivable method for attempting an appraisal of the living face. * * * It is advisable for a beginner to make two photostatic negatives of the same individual within a week of each other, so that appreciable changes in growth of the face cannot occur between them. These negatives are then accurately marked and when placed over each other in the illuminated field their respective points, straight and curved lines should be in perfect continuity."

"The median plane is inapplicable on profile photos (norma lateralis) for the measurement of bilateral relations. There can be no objections to the taking of photostatic pictures of the front of the face. The nose-board must then be turned at right angles to the photostat-beam. However, lateral symmetry may be exhaustively calculated on the gnathostatic casts; the relation of the zygomatic arches and the bi-gonial width are perhaps the only ones which cannot be determined on them, because they must be observed in norma frontalis. But it is more convenient to measure the bi-zygomatic and bi-gonial breadth directly on the head with calipers." (Simon.)

IV. THE TECHNICAL REQUIREMENTS AND DETAILS OF PHOTOSTATIC PROCEDURES

The diagnosis of a dental anomaly, involving the facial lines, can be completed with the aid of a photostatic negative in conjunction with gnathostatic casts and the occlusal and sagittal curves; but most practitioners will prefer prints from their negatives. These present a more lifelike appearance than the negatives; nevertheless the horizontal and orbital planes, as well as the mandibular lines, can be drawn on the negatives. The one-quarter natural-size negatives and prints are large enough for all practical purposes. A film-pack adapter, containing 12 films, can be substituted for the plate-holders and this permits reloading in daylight, without retiring to the darkroom.

Since the introduction of the Simon method of diagnosis, it has frequently been said that the casts are clumsy in appearance (Fig. 7) and the pictures should be larger. The fact remains, they are accurate and scientifically adequate and reliable. There is no objection to taking larger pictures and full front, or three-quarter views; and, if one is so disposed, impressions and casts according to former methods may also be taken. But the practitioner will soon be convinced that the old methods were not accurate. In a full practice the factor of time will control this to some extent; in a limited practice it will remain a matter of economy.

In my own work, the Simon methods are the methods of first choice and life-size photographs are resorted to purely as a matter of completeness in exceptional cases, and in research work on anatomically correct dentures. This routine results in considerable economy.

Pyro developing solutions prepared according to the manufacturer's formulae and chrome-alum fixing bath have given the best results for negative development. For the small-sized pictures the $3\frac{1}{4} \times 4\frac{1}{4}$ Kodak film packs are used for negatives, and for life-size work Eastman's "superspeed" portrait films, 8×10 inches, are employed.

After the negatives are finished, they are placed on an illuminated field (such as we use for the study of radiograms) and transparent, celluloid patterns are then placed in position for marking the print margins. For one-fourth natural-size negatives, this pattern measures 6 × 9 cm.; for the life-size negatives 16 × 22 cm. These patterns have horizontal and diagonal lines etched into them, to facilitate their placement, and their sides form exact right angles. The printing matts are cut out to the same respective sizes and accurately placed on the marks scratched on the negatives, so that prints of uniform size result. The left margin of profile-prints always forms a perfect perpendicular to the horizontal plane of the head. This minor detail is a great advantage in any cursory examination of a photograph.

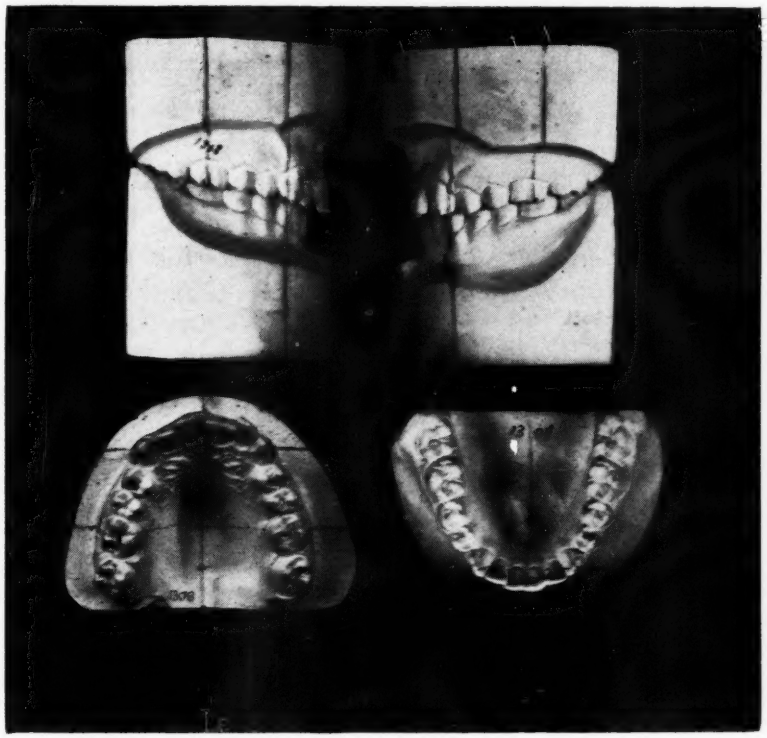

Fig. 7.—Gnathostatic casts of the individual shown in Figs. 5 and 6; the top of the casts is the same horizontal plane shown in Fig. 6 and the frontal, or orbital, plane is also shown in the illustration.

Various kinds of print-paper, in many weights and speeds, have been tested, but Azo, F 4 gloss, single weight, is our paper of first choice. If this is squeegeed on plate glass while wet, a perfectly flat, smooth, glossy print results, which brings out the details and enhances its value for half-tone reproductions. Linen backs may be applied before removal from the glass, and since squeegeed papers are usually single weight stock, this method promotes their durability. If a matt surface is desired, a double weight, matt-surface paper should be used. This type of finish reduces the time required and permits our drawing the diagnostic lines in lead pencil. Of course, the kind of paper used depends, to some extent, on the quality of the negative and the subsequent use of the pictures.

The photographic film, prints, drawing of the curves, written diagnosis and history chart, etc., can all be filed in one envelope, bearing the patient's name and case number, which is a great convenience.

An index should be kept of all negatives and prints, and their numbers recorded on the record-sheet of the case.

CONCLUSIONS

1. The Simon orthodontic-diagnostic methods (consisting of gnathostatic dental casts and photostatic profile photographs) are entirely satisfactory for practical and scientific diagnostic procedures and, in our hands, displace all other methods.

2. The dental casts and facial photographs of an orthodontic record should be coordinated in a manner that they substantiate the diagnosis. The customary dental casts and facial photographs are worthless in this respect.

3. The jaws beyond the maloccluding teeth are frequently involved and the true nature of a dental anomaly is not revealed in the casts and photographs made according to former methods; an exclusive, intraoral diagnosis is an antiquated and deficient mode of diagnosis.

4. Gnathostatic dental casts and photostatic facial photographs provide a scientific approach to the many difficulties encountered in orthodontic diagnostics.

5. The biometric and cephalometric demands of investigations of these problems can only be satisfied if we approach them in this manner; we urgently need a statistical, gnathostatic investigation of a large number of anatomically correct dentures so that we may gain a better, more rational comprehension of the individual denture.

6. Dental college clinics, and the departments of orthodontics in our university dental schools should become centers of research for the prosecution of these and many other tasks which await solution.

7. The photographs of an orthodontist need not be "beautiful," but exact. The equipage of diagnostic procedures in the realm of medicine and surgery are not objects of art. The orthodontist is not a specialist in cosmetics; he should be an authority in dentofacial orthopedics.

DISCUSSION

Mr. Loyd A. Jones, Rochester, N. Y.*—It is with a feeling of considerable timidity that I appear before this very distinguished audience. I feel somewhat out of place in attempting to speak to a group of specialists with whose work I am so unfamiliar. I am glad that the chairman of the executive committee has corrected the impression given by your program, since I have no formal written discussion of this paper to present. Dr. Lischer's manuscript was forwarded to me and I read it with great interest. A few days later I received copies of papers by Dr. Dewey and Dr. Simon. These papers I attempted to read, but I must confess that it was almost like trying to read a manuscript in Greek or Sanskrit. The highly specialized vocabulary of orthodontia is quite unknown to me, but perhaps we can find some common ground and some matters of

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common interest to discuss. It has been my experience in the past that one of the greatest causes of misunderstanding between specialists in different lines of work is their inability to understand each other. The same words are frequently used with entirely different meanings and technical vocabularies are so highly specialized that different individuals are not aware that in reality they are discussing the same fact.

I want to congratulate Dr. Lischer on this very excellent paper. It is gratifying indeed to see that he has applied purely quantitative methods to his work on the subject. To one who has been for many years interested in the development of photographic equipment and materials, it is gratifying to learn that photography is finding a real application in a new field. The layman naturally thinks of photography as of little use except for the making of portraits, motion pictures, and amateur snapshots; whereas it may be made a useful tool in many different lines of scientific investigation.

I do not believe that there are any statements in Dr. Lischer's paper to which I would take exception. The photographic procedure is entirely sound and in my opinion the photographs made by the technic outlined by Dr. Lischer and Dr. Simon will answer the purpose for which they are intended. I assume that some of the questions which will come up for discussion are those relating to focal length, depth of focus, distortion, etc. I would like to say just a few words relative to depth of focus. With the photographic lens we are attempting to obtain a reproduction of objects distributed in three dimensions. It is obvious with a lens that it is impossible to obtain perfectly sharp definition on a plane surface, such as photographic material, of objects distributed in three dimensions. The vital question, therefore, is just how close we can approach perfection in this respect. Depth of focus, that is the magnitude of the range of object distance through which satisfactory definition is obtainable depends only on the aperture ratio of the lens. The aperture ratio is obtained by dividing the focal length by the diameter of the diaphragm or stop. Thus if a lens has a focal length of 6 inches and a diaphragm diameter of 1 inch, its aperture ratio will be 6 and any lens having the same aperture ratio, for instance focal length 12 and diaphragm diameter 2 inches, will give the same depth of focus. This is one of the fundamental laws of geometrical optics. The statement is frequently made that a lens of certain type will give greater depth of focus than other lenses. Such statements are usually misleading and are true only if the lens in question is working at a greater aperture ratio than the lenses with which it is compared.

It is not necessary for practical purposes that a geometrical point in the object be reproduced as a geometrical point on the image plane, that is the photographic plate. The photographic plate itself consists of silver halide grains imbedded in a matrix gelatine and the image formed on the plate is therefore made up of a collection of grains of finite size. This necessarily makes it impossible for the photographic plate to render or resolve detail smaller than a certain limiting value. In other words the photographic plate has a finite resolving power and nothing is gained by using an optical system of resolving power much greater than that of the photographic material. Moreover the human eye itself which is used for viewing the photographic results has a certain finite resolving power below which it is impossible to see detail. In computing depth of focus it is customary to assume that a focal image of less than a certain magnitude is satisfactory for all practical purposes. The departure from perfect theoretical definition is easily stated by giving the diameter of the circle of confusion which is the diameter of an image of a point source formed by the lens system in question. Of course the depth of focus obtained by this method will depend upon the magnitude of the circle of confusion chosen as a basis for computation. If the negative is to be enlarged then it is necessary to choose a smaller diameter for the circle of confusion than if a contact print is to be made and viewed directly. The usual value used by manufacturers of photographic lenses in computing depth of focus is 1/200 inch. This value is sufficiently small to allow for some enlargement and is more than ample in all cases where the negative is to be printed by contact. It may be of interest to consider some specific examples with which to illustrate depth of focus as determined on this basis. Let us assume a lens having a focal length of 8 inches and working at an aperture ratio of 8. Now if we wish to photograph an object and

obtain an image ¼ actual size, magnification equal to ¼, the image distance (distance between the principal point of the lens and the focal plane) will be approximately 10 inches and the object distance (distance between the principal point of the lens and the object) 40 inches. Under such conditions if we adopt a circle of confusion of 1/200 inch diameter it will be found that objects 1.25 inches and farther away and nearer than the 40 inch plane will be in satisfactory focus. The depth of focus is therefore 2½ inches. Referring now to one of the photographic which Dr. Lischer has shown it appears that the depth of focus required in making one of his profile pictures is approximately 5 cm, which is 2 inches. It is evident, therefore, that an eight-inch lens working at f. 8 and at a magnification of ¼ will give practically perfect definition throughout the depth of the object used in this kind of photography. The same satisfactory definition will be obtained with any lens working at an aperture ratio of 8. It seems, therefore, that the choice of focal length of lens best suited to this type of work is dependent on factors other than depth.

I believe the word "distortion" as used in reference to orthodontial photography refers specifically to the distortion of perspective. I should like to point out that the term "distortion" as used by the lens optician refers to an entirely different phenomenon, the inability of a lens to reproduce parallel lines of the object as parallel lines on the image plane. Thus some lenses produce a convergence of such lines near the optical axis and others a divergence, these types being referred to as pin-cushion and barrel distortion. In discussing this matter with a lens specialist, therefore, you should be certain that he understands what you mean when you use the word "distortion" in referring to distortion of perspective. Perspective distortion is again a function of the distance between the object and the image as related to the focal length of the lens and the distance between the eye and the print or negative when observed. If any photographic print or negative be observed with the eye at the same distance from the print as the distance between the lens and the photographic material when exposed in the camera, no distortion of perspective occurs. It is evident that it is impossible to obtain this condition when a lens of very short focal length has been used. Thus a photograph made with a three-inch lens would have to be viewed with the eye three inches from the print in order to eliminate perspective distortion. Obviously this is impossible for the eye cannot accommodate itself for objects at a distance of three inches. If it be desired to produce a print in which there is no distortion of perspective the focal length of the lens must be equal to the viewing distance. This is not realized in the great majority of photographs taken and hence distortion of perspective is frequently present. In most cases, however, especially where the object is at some distance from the lens, the magnitude of the perspective distortion is so small as to be inappreciable.

The lens which Dr. Lischer has used in making orthodontial photographs has a focal length of 25 cm., 10 inches, and at a magnification of ¼ the object distance would be 12.5 inches and the image distance 50 inches. Under such conditions perspective distortion will probably be negligible to within the allowable tolerances. Again the question of allowable error must be considered. For instance the astronomer in determining stellar positions would not be willing to tolerate errors of more than 1/100 of a millimeter. Your requirements, however, are probably not so severe. It is probable that an error due to perspective distortion of ± 1 mm. would not be serious. Working at a magnification of ¼ with a lens of 8 or 10 inches focal length I am sure there would be no errors due to perspective distortion of this magnitude. Dr. Lischer has emphasized the necessity for standardization of all conditions, and I can only endorse this recommendation most heartily. In using photography for scientific purposes this is of greatest importance and in cases where photographs must be taken at widely separated periods of time the needs for precise standardization is preeminent. If reliable information is to be obtained it is absolutely necessary that the relation of the various planes in the object to the optical axis of the camera be definitely known.

I do not at the present moment think of anything further to say in regard to this subject. I am gratified to see that you are approaching this matter in such a scientific and businesslike manner.

The focal length of a lens is the distance between the principal point of the lens and the image of an object at an infinite distance from the lens. The principal point of the lens is that point in space at which the principal rays cross or intersect. In the case of photographic objectives the point is usually located within the lense some place between the front and rear surfaces. Its exact position relative to these surfaces depends entirely upon the lens type. The focal length as defined above is the value which must be used in all computation of magnification, depth, object and image distances, etc. It is not sufficient to measure the distance between the image of a distant object and the rear surface of the lens. The actual focal length of the lens as defined above must be known. The position of the principal point of the lens can be located experimentally. Suppose the lens be set up in a mount in such a way that it can be rotated about an exis perpendicular to the optical axis of the lens. Now if an image of the distant object be formed on a suitable surface so that it can be observed while the lens is rotated about the axis perpendicular to its own optical axis, the image of the object will move laterally unless the axis of rotation passes through the principal point of the lens. By moving the lens backward and forward a position can be found at which the image will not move laterally and we then know that this axis of rotation is passing through the principal point. If the object of which the image is being formed is at infinity, or at a distance very great as compared with the image distance, we may then measure directly the distance between the axis of rotation and the image. This will give us directly the true focal length.

If a lens having a focal length of 20 inches be used a natural sized figure, magnification of 1, will be obtained when the object distance is 40 inches and the image distance is 40 inches. To determine the relation between object and image distance it is only necessary to apply the simple equation $\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$

where u is equal to the object distance

v is equal to the image distance

f is equal to the focal length of the lens.

If the same lens, 20 inches focal length, now be used to form an image ¼ natural size, a magnification equal to ¼, the image distance becomes 25 inches and the object distance 100 inches. Perspective distortion will be appreciably less in the latter case, that is where the magnification is ¼. The perspective distortion in an enlargement will be exactly the same as that in the original negative or print. In making an enlargement we are merely transferring from one plane surface to another and hence no variation in perspective distortion can exist. If the lens system used in making the enlargement is not perfect, however, distortion of other types will be introduced. Assuming however that no such distortion is introduced in making such an enlargement the perspective distortion in a full-sized print obtained by making an enlargement from a negative taken at ¼ magnification will be less than that existing in the full-sized print made directly at a magnification of unity.

Dr. C. A. Hawley, Washington, D. C.—I think I would like to take this opportunity before commencing the discussion of the question of the paper proper to commend most highly the scientific attitude of our essayist. We certainly ought to appreciate a man who can do all this work shown here, which covers ten years of photography (and the best work to my mind which has been done in that field) and who then frankly says that the most important point has eluded him and to freely give the credit to the man who has discovered it. That is an attitude which is generous and scientific; in fact, an evidence of the highest devotion to truth, a mark of a real scientific man.

When we think of the photography that has been done up to the time that Professor Simon discovered and developed its proper correlation to the teeth and skull, it seems worth-

less. We have had pointed out to us at the time we started orthodontia, and from time to time ever since, the value of photography and the necessity of taking these records, and yet we have not taken photographs in such a way that they taught anything in diagnosis. It showed the change in the face, but not where. Just what the improvement was and what difference it made in the plans of treatment was not disclosed. The photographs which are taken without a standardized position of the head, standardized size and anatomical point to compare from, give us little information. This photostatic method does that. A photograph taken in this way can be compared, not only for instance with my own at a subsequent time, but suppose I wish to send a patient who has removed to St. Louis to Dr. Lischer, I can send the photograph marked one-half life size to him and he can take another later and know that it represents exactly the changes that have taken place in the face. I think one test suggested by Dr. Simon has escaped Dr. Lischer, and that is, that a photograph should be so accurate that we can take one now, and one an hour later, or a week later, or two weeks later, before a time when growth would make any changes, and superimpose the negatives and have them absolutely and accurately correspond. The ability to do this proves that your technic is correct. The essentials of orthodontic photography can be boiled down to two things: First, your photographs must be uniform. If you start with one-quarter size or one-half size, they must all be that size. Second, they must be exact; that is, the position of the patient must be exact and this is the only method I have ever seen in which these things could be done.

I gained my inspiration for better photography from Dr. Lischer about three years ago and bought my apparatus for taking life-size and one-half life-size photographs after his suggestions. However, I think the apparatus designed by Dr. Simon is efficient and well adapted to orthodontic uses. I fitted my large camera with a focusing beam and made a nose-board similar to the one in apparatus. Personally, I like the one-half life-size best.

Mr. Jones has spoken of the necessity of a long focal lens, and my experience would indicate that that is very essential to get undistorted pictures. My advice from Dr. Lischer in the first place was a lens of not less than 19″ focus. I had an opportunity to purchase a B & L—Tessar lens, 19½ inch focal length which covers a 14 × 17 plate, and did so. I use an 8 × 10 plate. It is large enough to take measurements from in a very accurate and simple way. If you use a short focus lens, your lines are spread out and you do not see the photograph at the same distance you see it with your eye. In using a standard size in this method, if you have one patient with a small head and one with a large head, it will be indicated at once on the photograph. I have one or two slides here which I would like to show you to illustrate depth of focus.

Slide 1.* In regard to length of focus, you see this hair is in good focus, the center of the focus is at the line of the profile, but these other points are in good focus just as you would see them with your eye. That means there is very little distortion. In many of my earlier photographs, the exact line of the profile would be in focus and the ear and hair and other parts of the face would be out of focus, which means distortion. I stop the lens down to 22 to give depth of focus.

Slide 2. This, you see, has depth all through it—the hair, ear, etc., are in good focus, but, of course, it is centered on the median line of the face. I think we ought not to be confused in this matter of what we need. You can discuss lenses almost indefinitely and cameras the same, but we should come down to these two essentials which Dr. Lischer has mentioned; i. e., that photographs must be uniform in size, and the position must be exact and always the same.

There are many cephalometric methods being proposed, but they must be adapted to office practice. For instance, suppose you attempted to make plaster casts of the face, as did Dr. Case and others—they represent exact conditions, but what are you going to do with all the face masks? You would have to have a separate office building for storing them. We want a method, not for special cases, but one that is practical and simple for all cases as a regular office routine. You can use Eastman portrait films in this method

*Slides not obtained for publication.

and file them conveniently away. The apparatus occupies only a small space, it takes about two minutes at the chair, and not a great deal more laboratory work. When properly standardized, all the work can be done by an assistant, if you so desire. I prefer to make the exposures myself because I like it—it is a fascinating diversion.

Dr. Alfred M. Desnoes, Brooklyn, N. Y.—May I ask Mr. Jones to explain what is meant exactly by the focal length of a lens.

Dr. H. C. Ferris, New York, N. Y.—Eighteen years ago I wrote a paper upon a method of standardization of our photographic records and am still practicing the same technic.

I will here show you some photographic illustrations of my technic over a period of years for the same patient.

My method is as follows: The subject is photographed in three positions,—full face in repose, full laughing view, and profile of most deformed side. The patient is seated about four feet from the camera, which has a lens with a focal length of 19¼ inches. On the ground glass of the camera is drawn two parallel lines 3¼ inches apart between which the head is focused.

The subject's shoulders are paralleled with the ground glass, the head levelled on a line from the center of the lens, bringing the nasion and the external auditory meatus in this plane.

The profile position is taken with the shoulders in line with the camera, the head gradually turned away until the eyebrow on the far side disappears, with the nose in the same plane as the other positions.

The face is lighted from aloft at an angle of about 45° which casts a shadow bilaterally on all defects of the face and under the chin.

This gives me an artistic value and a standardized comparison of heads, which seems to be missing in the method described by Dr. Lischer, but the principles might be readily combined with my method.

That there is a distortion in the heads is more than likely, as in all methods and I would like to have the opinions of the experts present, on this subject.

I will now present illustrations where the head is taken at a fixed focal distance before and after treatment according to Dr. Simon's method, and then other illustrations with three records of the same subject according to my method with the heads all the same size.

From my viewpoint, the comparison of the heads is more intelligible and enables me to make corrections for their artistic value; although I appreciate the importance of Dr. Lischer's technic and would be inclined to expand upon it. I believe the heads in his routine methods are taken too small for careful study.

As the cases which I have shown are from my private practice, I regret my inability to have them go to print.

Dr. Frank A. Delabarre, Boston, Mass.—I feel that I cannot let this occasion go by without paying my respects to Dr. Lischer and assuring him that whenever he presents a paper before this or any other organization we listen to him with respect, because we acknowledge his scientific approach to his problem. I have little to add to what he has said because he has so far outstripped anything I have done in this matter. I feel that it is as necessary to take full face pictures as it is to make the profile. We get a more glaring distortion from the normal development of the face in the profile with retrusion or protrusion of the chin than in the full face. However, we do get distortion in the full face where we have a departure from symmetrical lateral growth, and this would disclose such things as the nose or chin displaced to one side. The study of the full face is just as important as the study of the profile. I want to thank you again, Dr. Lischer for your standardization of a difficult technic.

Dr. Ralph Waldron, Newark, N. J.—I received a copy of Dr. Lischer's paper several days ago, as did most of us, but I did not think there was anything really to discuss because of his able presentation and the points dwelt upon by the other members. There are a few points I would like to straighten out. Dr. Delabarre spoke about full face views. I have adapted the camera to one-half size—using lens with focal length of 19½ inches, and with all due respect to Drs. Lischer and Hawley, I still find in full facial views there is some distortion even with 19½ inches focal length. I feel the orbital plane as given to us by Simon shown in our gnathostatic models will answer better than any system we can devise of placing models in full face view. I have a method of taking those full face views with the same relations by marking off the various other points shown by Dr. Lischer so that I can get an absolutely full face view exactly the size of the profile view, i. e. ½ size life. With a smaller camera you can focus as fine as the line will allow you and get ¼ size view . . . . . and with a larger camera with 19½" focal length where you can use an 8 × 10 film you can get one-half size on your ground glass, and you will find a slight variation. For this reason I have adopted a large size and I think Dr. Lischer can answer the question as to whether there is slight distortion.

Dr. Lionel Hartley, New York, N. Y.—I wish to thank Dr. Lischer for his very valuable paper and I do not think there is any doubt about the scientific basis of it. There is a certain amount of standardization which the average practitioner must use if he attempts photography, as regards his time. That is, to standardize his exposures, developments, etc., and this can be very easily done by using a fixed source of light at some distance, determining the stop for exposures, with the object always at the same distance from the camera, etc. Films developed in a tank with a given formula and given length of time and temperature will generally give negatives of about the same density. I think the size Dr. Lischer shows in the one quarter pictures about the best for a man to take. If he needs larger pictures to look at, he can enlarge from one-half size to full size without perspective distortion. Then it isn't necessary for a man with an average pocketbook to invest in a 1 C. Tessar lens and then stop down to F 22, because he can get almost the same results from a well-focused portrait lens, or pretty nearly any lens will do, for by only using a pinhole you can get absolute depth of focus and no distortion, but of course exposure must be longer. So you must determine upon a uniform stop to use as well as uniform amount of exposure. If you have a restless person, or insufficient light, you will have to open the stop of the lens wider, and then you will not get the depth of focus as if it were stopped down. A shorter focus lens gives you better definition at a larger apperture than a smaller lens etc. That is a point which we have been having a little discussion about over here in the corner. However, you can standardize these things very easily. For enlargements the equipment put out by the Eastman Kodak which automatically focuses by raising and lowering is very practical. You can establish it at a certain magnification and you can set it so the enlargement can be made as clearly as a print, but this subject takes so much time to talk that we will postpone it for now.

Dr. C. H. Juvet, Ottawa, Canada.—I would like to express my appreciation to the Society for the very hearty welcome they have given me and the privilege of hearing Dr. Lischer's paper. I am satisfied of the very great benefit I have received. I feel through listening to Dr. Lischer I may go back home feeling that perhaps I ought not to have come down here. I have followed photography very interestedly through many developments, having followed Dr. Delabarre for a while, then Dr. Lischer with his life-size standardizations, which I immediately swallowed whole and purchased an outfit, and now I have come down here and feel like a frog out of water, two or three hops behind all the time. One point I would like to bring out, and that is to ask Dr. Lischer, or rather to state that I am still convinced that life size is the best photograph to take. I would like to ask Dr. Lischer if he claims or contends that in our orthodontic work the one quarter size will give the full area of bone development and bone stimulation that is brought about, or changes made in the features, that is, I mean all the changes in the features brought about by or

through orthodontic treatment. I doubt if they can be demonstrated on your one quarter size photograph.

Dr. A. W. McCelland, Montreal, Canada.—I wish to express my appreciation and thank Dr. Lischer for what I have listened to, and I am sure my photographic procedure which I have been following out for several years could not be much improved.

Dr. A. Wolfson, East Orange, N. J.—I would like to ask Dr. Lischer to what extent his treatment of malocclusion is guided by the Simon diagnosis.

Mr. Van Allen, New York City.*—I do not know that there is anyhting that can be added. Dr. Lischer has an unusual photographic knowledge, and it is rather gratifying to note that there has been some effort to standardize this matter. I have found everything being used from a 3A Kodak to a large 8 × 10 camera. In standardizing, your photographic problems become easy, and the procedure is not difficult even for a novice. A few hours of instruction will give you efficiency. I might call attention to our service department at 235 West 23rd street, and state that information and advice is free to you there at any time.

Dr. Wm. H. Gilpatrick, Boston, Mass.—I also have taken great pleasure in listening to this paper by Dr. Lischer, and I have made up my mind to go home and throw my old material away and start over again. Mr. Van Allen comes around to my place every time he is in Boston and he always has something new and interesting, and helps me out of many difficulties.

Dr. Lischer (closing discussion).—Most of the points brought out in the discussions were referred to in my paper. One can make artistic pictures after a little experience, and they are pleasing and even attractive at times; but that is not what we seek in a *diagnosis.*

In reply to Dr. Wolfson, I wish to say that our treatments are certainly guided by the diagnosis. You are all familiar with the term "Class II," which was predicated on the assumption that the mandibular arch is always posterior in its relation to the maxillary arch in these cases. But if you will use these new methods of diagnosis you will be convinced (as I have been) that in approximately fifty per cent of the cases formerly accepted in this class, the lower arch is normal and the upper arch is anterior in its relationship—a fact of great importance in treatment.

For the first time, with the aid of these methods, we are able to accurately comprehend the human denture in three dimensions *and in its relation to the head*: the relation of the occlusal plane to the horizontal plane; the width of the dental arches and their relation to the median plane; and the anteroposterior relation of the arches to the frontal (orbital) plane. The same frontal, median and horizontal planes are used on the plaster casts and photographs.

Dr. Delabarre referred to a clinic given by Dr. Brandhorst in Atlanta, which was very well executed, but it is a procedure which is not essential for diagnosis. What Dr. Simon has tried to do is to reduce all these procedures to a "*maximum-minimum.*" In other words, what is the least we need, of floor-space, time, expense, exposure, etc., and yet, at the same time, be accurate.

Like Drs. Hawley and Waldron, I, too, have an expensive lense and camera; which I bought during the "days of my innocence." But they don't eat any more hay; hence we use them, occasionally, to get additional joy out of our work. Simon's methods, however, give us the results we seek. The pictures, drawings and casts are accurately coordinated. Stereoscopic pictures fail us in this latter respect.

Of course, there is no objection to taking half-size photographs, like Hawley and Waldron are doing; or natural size for that matter; it is all a matter of personal preference. Similarly, you make take front views, if you like, because they are interesting, but

*From the Eastman Kodak Co.

they are not essential for a differentiation of anteroposterior malrelations of the dental arches, or of jaw deformities. The casts show the relation of the denture to the median plane; and direct measurements like the bi-zygomatic and bi-gonial width may be taken to substantiate, or complete, our deductions regarding this relationship.

In reply to Dr. Waldron, I admit there is some distortion in natural size pictures; there is less in half-size; and there is still less in quarter-size. And if you enlarge the latter, we have eliminated the recurrence of the distortion. The actual size of a picture is less important than a certain definiteness in other respects, and if a quarter-size picture complies with the latter, then it is adequate.

Please remember: the median plane of the patient's head is parallel with the plate in the camera and always the same exact distance from the lens; that the central axis of the lens and the two orbital points are in the same line; hence the profile negative is a perspective projection and that is what is implied in a "*photostatic*" photograph. And because of this precaution, we can utilize it for certain desirable metric measurements, which, in turn, permit us to coordinate it with the dental casts. Finally, any photograph which does not permit this latter, accurate use, is of little, or no, diagnostic value.

WATER SUPPLIES CHARGED WITH DISFIGURING TEETH*

Remarkable Effects of Certain Waters on the Growing Enamel—Specific Cases Cited—Room for Investigation by Water Works Chemists

By Frederick S. McKay, D.D.S., New York City

THE very unusual dental condition described in the following remarkable article, which, the author seems to show conclusively, originates from the water supply of the districts affected, should stimulate the water works fraternity to great exertions in determining the nature of such peculiar effects arising from some unknown cause contained in the water. The discovery of the remedy, also, apparently, depends largely upon joint investigation of water works chemists and engineers and the members of the dental profession:

The investigation of a certain extremely disfiguring defect of the enamel of the human permanent teeth, known as "mottled enamel," has, during the past fifteen years, been brought to the point where it has been proved that this defect is definitely associated with and dependent upon the use of certain waters for drinking and cooking during early childhood.

The establishment of this fact makes it important that this problem be brought to the attention of water chemists and engineers and superintendents of municipal water systems throughout this country, and it is for this reason that the Editor of *Water Works Engineering* has requested this article. In complying, it will be my aim to deal particularly with the water aspect, and to avoid those phases that are technically dental, so I shall embrace these latter only to such an extent as may be necessary to a reasonable understanding of the problem.

NATURE OF THE ENAMEL OF THE TEETH

The enamel of the teeth as normally formed is a dense homogeneous structure, of extreme hardness, uniformly whitish in color and practically entirely inorganic in its chemical compositon. This uniformity of structure has been a characteristic of enamel from prehistoric man down to modern times, regardless of race, climatologic conditions or diet, and the general attitude of dental scientists is that, having completed its development upon the eruption of the tooth into the mouth, its structure is incapable of undergoing any further change that could be considered in the nature of a growth or development, or even deterioration, except when attacked by environmental conditions in the mouth. This is only another way of saying that whatever defects in structure enamel may be present must be acquired during the period of its growth or development. In other words it erupts as a completed structure.

The amazing peculiarity of mottled enamel which makes it distinct and separate from any other dental defect, is that it occurs only in definite geograph-

*Reprinted from *Water Works Engineering*, January, 1926, lxxix, No. 2.

ical areas of which there are several in this country, and the further distressing fact that in such afflicted districts practically all children who are born there

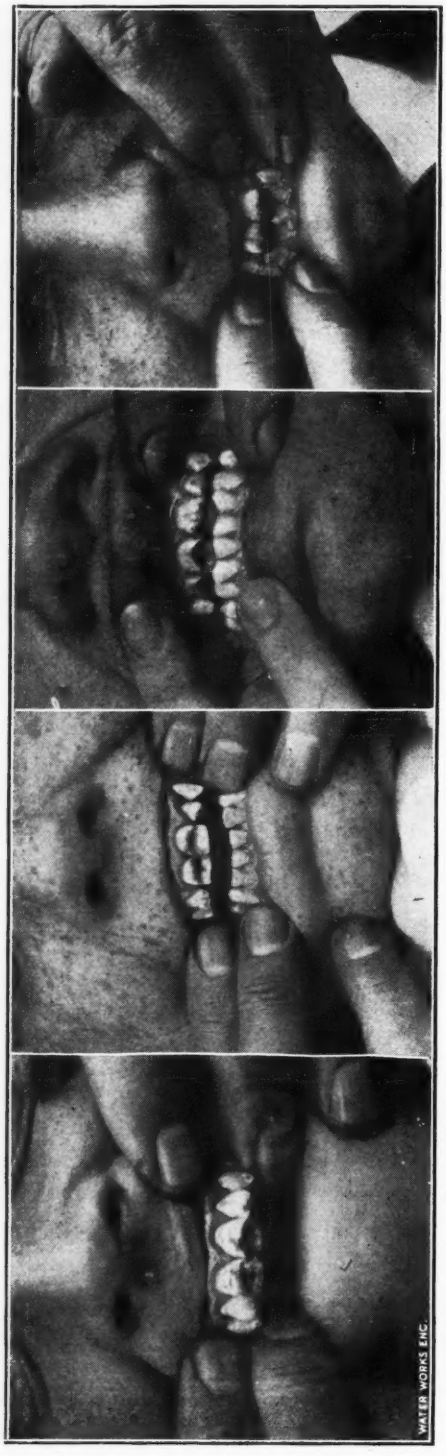


Fig. 1.—Some typical cases of defective enamel caused by water supply from various parts of the country.

and who live there during the period of enamel growth will, when the teeth erupt into the mouth, present this defect. In order that my readers may have an adequate conception of the appearance of this condition, I present illustra-

tions of typical cases (Fig. 1), which have been observed in various parts of this country, pointing out the characteristic that regardless of the geographical locality where this defect may occur, it always takes on this characteristic appearance.

DARK BROWN DISCOLORATION CHARACTERISTIC OF DEFECT

As may be observed from these illustrations, in the typical appearance this defect is characterized by the presence of a dark brown discoloration, even black in some cases, the distressing feature being that it is located right on the most conspicuous portion of the tooth; as a rule limited to the upper front teeth; rarely on the lowers, and practically never on the under or back surfaces. What this pigment is chemically has never been determined, and I may add that, being incorporated into the enamel structure, it is not removable except by extreme measures.

It is important to realize that communities have been examined where 90 and even 100 per cent of native children have teeth like those illustrated, and it should be further emphasized that in a community which has definitely been branded as "afflicted" the percentage of occurrence is usually around 90 among natives. In other words, if the defect exists at all it is practically universal, I repeat, among natives and those who came there during early infancy.

WATER PROVED TO BE RESPONSIBLE

Such uniformity in appearance and occurrence at once suggests a local cause acting indiscriminately upon all enamel grown in that particular environment, and the one uniform local influence is, of course, water. At least, this was the hypothesis upon which the investigation of this condition was started about 1908, and during the years following, the evidence gathered in the various afflicted districts has established the fact beyond any question, that the water is in some way, as yet not determined, responsible.

Having outlined the general situation briefly in this way, I will undertake to present the conditions as bearing upon the water in the various afflicted districts in such detail as may, I hope, be of interest to the readers of this Journal.

PIKES PEAK REGION FIRST INVESTIGATED

The first region in which this problem received any detailed attention was in that group of communities located about the base and slopes of Pikes Peak in

TABLE I

ANALYSIS OF COLORADO SPRINGS WATER

Constituents (Ions.)	*Parts per million.*
Sodium (Na) / Potassium (K)	3.20
Calcium (Ca)	5.70
Magnesium (Mg)	1.70
Iron / Aluminum (Al)	.49
Chlorin (Cl)	7.29
Sulphuric acid ion (SO_4)	7.10
Carbonic acid ion (Co_3)	15.30
Silicic acid ion (SiO_4)	7.50
Organic matter	9.50
Total solids	57.78

Colorado, embracing the cities of Colorado Springs, Manitou, small towns in what is known as Ute Pass, and the Cripple Creek mining district, more famous

Fig. 2.—Teeth of three boys of one family in town of Pictou, Colo., using water from coal mine, who never lived elsewhere and have used this water supply all their lives. Left to right older, middle and younger boys; note development of discoloration in older boy.

then than now, and it is well to bring out now the fact that in these cities the data was collected, as it was in all other districts studied, by examination of

the children in the schools, taking a careful history of each child as to nativity and places of residence as well as the character of water used.

The enamel defect throughout this entire Pikes Peak region was found to be uniformly present in from 88 to 90 per cent of native children. The water supply of the region is derived from the Pikes Peak water shed from melting snow gathered into a series of lakes or basins located at about timber line (11,500 ft.) and is of unusual purity both as regards its organic as well as chemical contents, coming in contact with granitic formation chiefly, being conveyed to the city through iron pipes. An analysis of this water made by the city chemist of Colorado Springs (Fuller) is shown in Table I.

In view of the fact that the principal part of the food supply of these cities is imported, it cannot be argued that the disturbing factor is to be found there, and at an early stage of the investigation the suspicion naturally centered on the water. Yet a cursory examination of this water analysis disclosed no suspicious factor, at least as then determined.

Similar examinations conducted in neighboring small communities revealed the fact that the enamel defect was present in those whose water supply originated in the same mountain range in which Pikes Peak is situated, and on the contrary, those whose water was derived from other sources than the mountain range were immune.

WATER FROM COLORADO COAL MINE AFFECTS TEETH

A great mass of data obtained from other afflicted districts examined over a period of several years is necessarily omitted for the sake of brevity, but on account of the startling contrast with water gathered from high up on the mountain range, a recital of conditions found at the small coal mining camp Pictou, in Southern Colorado, is of interest. Here the percentage of affliction was found to be 100, involving every person native to this place, the damage to the enamel being of extreme intensity in very many instances. The water for the domestic supply here is derived from the coal mine, being pumped from the shaft to a tank on the hillside and distributed from there through pipes. An idea of the destruction to the enamel is conveyed by Fig. 2, showing illustrations of three boys in the same family who were born in Pictou and who never lived anywhere else.

TABLE II

ANALYSIS OF PICTOU MINE WATER, PICTOU, COLORADO

Ions.	*Parts per million*
Sodium (Na) } Potassium (K) }	276.77
Calcium (Ca)	89.75
Magnesium (Mg)	27.36
Iron (Fe)	nil
Aluminum (Al)	2.74
Chlorin (Cl)	47.37
Sulphuric acid ion (SO_4)	651.49
Carbonic acid ion (CO_3)	216.78
Silicic acid ion (SiO_4)	16.68
Organic matter	100.00
Total solids	1428.94

As bearing upon the food supply it may be stated that Pictou is situated in a region of intense barrenness, with no agricultural value whatever, hence the entire food supply is imported, even the milk, as there is no pasturage.

Collateral evidence of interest is in the fact that in the near-by town of Walsenburg, certain native adults were found who presented this enamel defect of intense character who, as children, used this water from the Pictou mine, it being hauled in barrels from the mine, as the available supply at that time at Walsenburg was not considered fit for use. To state this fact in terms of its dental relationship, these individuals grew their enamel under the influence of the Pictou mine water, with the result that when the teeth were erupted they bore this characteristic defect. An analysis of this Pictou mine water by Cambier, chemist of the Colorado Fuel and Iron Co., at Pueblo is shown in Table II.

A similar condition of the teeth was found at Chandler, a coal mining camp situated near Canon City, with the significant parallel that here, as at Pictou, the water was drawn from the coal mine. An analysis of this water by Cambier is given in Table III.

TABLE III

AN ANALYSIS OF CHANDLER MINE WATER, CHANDLER, COLORADO

Ions.	*Parts per million*
Sodium (Na) } Potassium (K) }	37.12
Calcium (Ca)	74.40
Magnesium (Mg)	16.71
Iron (Fe)	trace
Aluminum (Al)	trace
Chlorin (Cl)	14.17
Sulphuric acid ion (SO_4)	104.66
Carbonic acid ion (CO_3)	239.60
Silicic acid ion (SiO_4)	.....
Organic matter	84.00
Total solids	570.66

In the city of Alamosa, Colorado, this enamel defect was found for the first time during this investigation associated with the use of Artesian water, the significance of which will be apparent later in this article.

TABLE IV

ANAYSIS OF S——— FAMILY WELL AT LA FAYETTE, COLORADO

Ions.	*Parts per million*
Sodium (Na)	242.70
Potassium (K)	6.44
Calcium (Ca)	33.31
Magnesium (Mg)	33.60
Iron (Fe)	.....
Aluminum (Al)	3.35
Chlorin (Cl)	51.00
Sulphuric acid ion (SO_4)	250.00
Carbonic acid ion (CO_3)	530.00
Silicic acid ion (SiO_4)	18.12
Organic matter	.....
Total solids	1168.52

NOT ALL MOUNTAIN RANGE WATER AFFECTED

It is important to point out that many communities exist which derive their water from mountain ranges in which this dental defect does not exist, and it is also true that this same defect is found among persons who have been raised upon surface wells, that is, wells of a depth of about thirty feet. One such instance was the S——— family of La Fayette, Colo., whose children used water from a well in the yard and who presented the enamel defect in pronounced form. An analysis of this water by Eckley is given in Table IV.

A similar instance is the L——— family at Louisville, Colorado, an analysis of which water is given in Table V.

TABLE V

ANALYSIS OF L——— WELL WATER AT LOUISVILLE, COLORADO

Ions.	*Parts per million*
Sodium (Na)	207.80
Potassium (K)	3.35
Calcium (Ca)	31.80
Magnesium (Mg)	37.75
Iron (Fe)	.....
Aluminum (Al)	.....
Chlorin (Cl)	31.00
Sulphuric acid ion (SO_4)	142.40
Carbonic acid ion (CO_3)	615.00
Silicic acid ion (SiO_4)	21.65
Organic matter	.....
Total solids	1090.75

These instances are introduced to show that the waters associated with this defect are not necessarily derived from any particular source, but rather that any water which contains some certain ingredient or combination of ingredients, or perhaps lacking in some ingredients, will produce this defect if used during the period of enamel growth regardless of the source from which it is derived. In the Salt River Valley in Arizona, particularly at the town of Mesa, contact was again established, in relation with this defect, with a municipal water supply from a deep well. An interesting episode in this general locality was that on the Reservation of the Pima Indians at Sacaton in the Gila River Valley, 100 per cent of the children of this people exhibited this same dental condition. It is notable that on this Reservation there is no such thing as a community, hence no municipal water supply. Being an extremely arid country there are, on the scattered forms, not even wells, the water being obtained direct from the Gila River.

SUPPLIES FROM ARTESIAN WELLS AFFECTED

This scattered data I realize may be somewhat confusing, and it is introduced to indicate the wide range of occurrence of the enamel disturbance, so I pass to a description of other localities in which this condition is more definitely associated with a particular source of water, having reference now to artesian wells.

The first district in which mottled enamel was found to exist with any great intensity in relation with an artesian source of supply is at, and adjacent

to, Amarillo in the "Panhandle" of Texas. Although never having been examined by me personally, I have accepted as authentic, reports that this disturbance is definitely related there with the use of artesian water, such being, as I understand it, the source of the domestic supply. It is certain, however, that in that vicinity there exists a very large area, possibly 100 square miles, in which mottled enamel is present in a large proportion of natives. Other artesian districts in Texas are under suspicion.

So far as is known, the only two spots in the eastern part of this country where this defect originates are Franklin and Courtland, Virginia, and it is a fact that this condition was unknown there until the introduction of artesian water several years ago. It is certainly true that as revealed by an examination of the school children, no cases were found that did not give a history of use of artesian water.

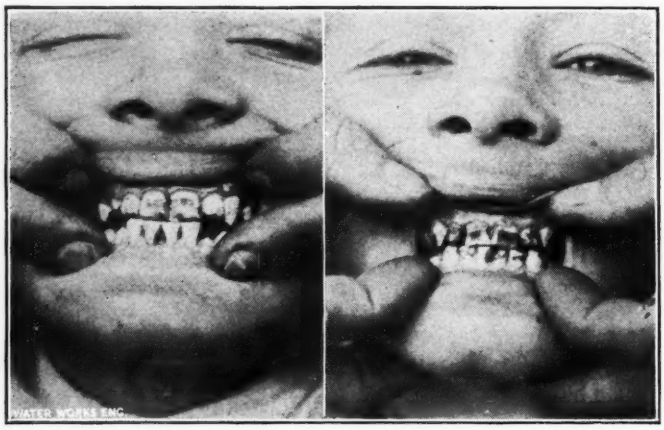


Fig. 3.—Teeth of twin boys, users of deep well water, showing mottled enamel. Members of this family not brought up on this water but drinking it in maturity, show no bad effects on the teeth.

ONLY ARTESIAN WATER WAS AFFECTED IN THIS DISTRICT

One of the most interesting localities studied during this investigation is in a well-defined artesian district in South Dakota, centering in the town of Britton and embracing such neighboring communities as Kidder, Langford, Andover and Pierpont. The usual examinations in these places revealed that the enamel defect was invariably to be found in those children who had been raised on artesian water, and in these same towns, those who had not used artesian water had normal enamel. One very interesting history was that of the H——— family at Kidder (see Fig. 3) in which the older children, who had been raised on water from a surface well in the yard, had normal enamel, while two younger children, twins, who were born the same year that the surface well was abandoned and an artesian well sunk on the premises, exhibited the enamel defect in a most pronounced form, as illustrated below.

It was significant also to note that in passing out of the artesian district into the neighboring town Havana, North Dakota, in which no artesian wells existed, no trace of the enamel defect could be found in the school population.

WELL ORIGINALLY DRILLED FOR FIRE PROTECTION

The history of Britton is interesting in noting that the artesian well was originally drilled in order to provide water under pressure and in volume for

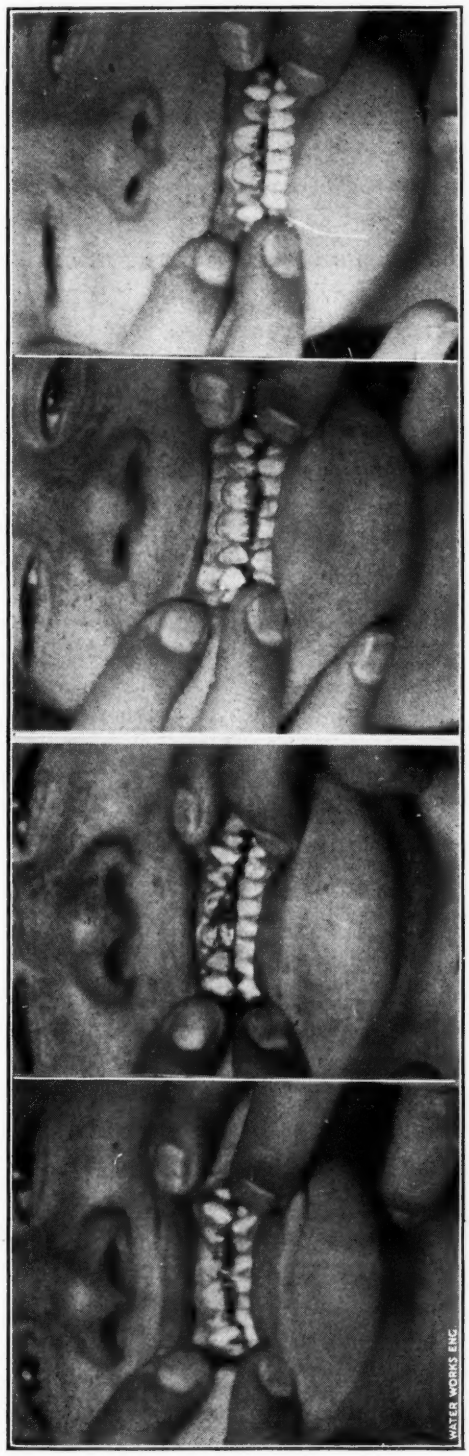


Fig. 4.—Bad cases of discoloration from use of the Oakley, Idaho, warm spring water.

fire protection, but was later appropriated to domestic use and it is a demonstrable fact that the development of mottled enamel has been subsequent to the

beginning use of the artesian water in a domestic way. Another fact that is puzzling to the writer as a layman from the water aspect is that there are other extensive artesian areas or districts in South Dakota that are free from defective enamel, for which I offer no explanation, but a comparative analysis of waters from these afflicted and immune districts would be interesting.

THE INTERESTING CASE OF OAKLEY WARM SPRING

But what is probably the most interesting episode within the progress of this investigation took place at Oakley, Idaho, within the past year. It seems that about 1908 this town piped in the water from a warm spring about five miles out, for domestic use, and as time went on it became increasingly apparent that the teeth of the town's children were exhibiting this disfiguring discoloration. Local investigators who were entirely unaware of the existence of such a condition elsewhere became convinced that the cause lay in the water, for it was found that no trace of such a thing existed prior to the use of the warm spring water, and furthermore that every child who had this defect gave a history of having used this water during the years of enamel growth. (Fig. 4.) Reversing the statement it would read that no child who had used the water during such years had escaped the defect. And further, that no child who had used other water, such as from a well, had the defect.

Backed by such evidence, a bond issue was authorized at a special election on February 9, 1925, from the proceeds of which the then present water supply was disconnected and water from another source turned into the system. To those who may be interested in knowing more in detail of this episode, a reprint of an article which was contributed to *Dental Cosmos*, Philadelphia, in September, 1925, will gladly be furnished by application to the writer.

CAUSE OF EFFECT OF WATER ON ENAMEL NOT FOUND

What the peculiarity is in the waters of these afflicted districts has not as yet been determined, which was particularly to be regretted in this Oakley episode for the reason that these people having been public spirited enough to discard the water which in all other respects was perfectly satisfactory, were at a loss to know what other water might be safely substituted, and their decision in favor of a certain other new source of supply was influenced largely by finding several children of one family who had used this proposed water during enamel formation, whose teeth were found to be free from the defect. Probably never before was a municipal water supply discarded and a new one substituted for such a reason as this. An analysis of the water from the Oakley warm spring is given in Table VI.

Conjointly it is interesting to note that two other places, fortunately of small population, have been located in California in which this same enamel defect is associated with use of water from warm springs.

There seems to be a curious analogy, which I suggest with some hesitation, between artesian waters which we have seen in such definite association with this enamel defect in various places, and other deep waters such as those from the coal mines at Pictou and Chandler, and lastly with these waters from warm springs, the temperature of which I understand to be dependent upon the depth from which they are derived.

TABLE VI

ANALYSIS OF OAKLEY, IDAHO, WARM SPRING

	Quantities in parts per million
Silica (SiO_2)	78.00
Iron (Fe)	0.06
Calcium (Ca)	2.70
Magnesium (Mg)	0.90
Sodium and Potassium (Na + K)	84.00
Carbonate radicle (CO_3)	19.00
Bicarbonate radicle (HCO_3)	69.00
Sulphate radicle (SO_4)	26.00
Chlorid radic e (Cl)	52.00
Nitrate radicle (NO_3)	0.23
Total dissolved solids at 180°C	308.00
Organic matter	3.90
Total hardness as $CaCO_3$ (calculated)	10.00

Date of collection, December, 1921.

OBJECT OF THIS ARTICLE

To come now in conclusion to the vital motive which prompts the submission of this article: Realizing the wide distribution of this dental defect in this country through Colorado, New Mexico, California, Arizona, Texas, South Dakota, certain of the Bahama Islands and Virginia, as at present determined, it is important that those who have to do with municipal water supplies should know of it, and the conditions under which it occurs, for the protection of the children, particularly those of generations yet to come.

The damage to those already afflicted is permanent, as no repair of the defective tissue is possible either through feeding or medication, it having been pointed out that enamel once formed is not subject to biologic or nutritional changes.

From the standpoint of practical water application it is felt that the chief source of danger lies in the installation of new artesian borings for domestic use. It has been shown how certain communities having innocently, without knowledge of the possible consequences, adopted an artesian installment, have inflicted this disfiguring blight upon their native children.

A specific example of such a possible consequence is to be found at Burley, Idaho, which city about a year ago having found the then present water supply unsatisfactory for reasons which cannot be here stated, issued bonds for the installation of an artesian supply for future use. The dental result will not be known short of six to eight years, and it is earnestly hoped that no disastrous consequences will result, but in the light of the experiences of other cities, the dangerous potentiality is present.

SOLUTION ONLY THROUGH COOPERATION OF WATER ENGINEERS

At present no source of information is available through which water engineers may be warned of this particular danger which may exist within a municipal water supply which for all other purposes may be entirely satisfactory. The problem is then essentially one for the water chemist and its solution can only be arrived at through his cooperation. With this point in mind, the writer earnestly solicits information which may lead to the location of new areas of affliction, or interpretations of analyses included in this article or other

later analyses which may be undertaken with this problem in mind. It might be suggested by some of my readers that experimental feeding of suspected waters to certain animals might bring results, and so far as the writer knows, this has never been done, principally because no well authenticated case of this defect has ever been observed in any animal. For convenience in comparison there is appended below a table of analyses of waters from several districts in which the dental defect has been found in its characteristic uniformity of appearance and occurrence.

TABLE OF ANALYSES OF WATER FROM AFFLICTED DISTRICTS

GIVEN IN PARTS PER MILLION

CONSTITUENTS IONS	OAKLEY WARM SPRING	MINE WATER AT PICTOU	MINE WATER AT CHANDLER	L.... RANCH WELL WATER	S.... WELL	CITY WATER AT COLORADO SPRINGS
Sodium	84.00	276.77	37.12	207.80	242.70	3.20
Potassium	.....	.....	.....	3.35	6.44	
Calcium	2.70	89.75	74.40	31.80	33.31	5.70
Magnesium	0.90	27.36	16.71	37.75	33.60	1.70
Iron	0.06	Nil	Trace	.....	3.35	.49
Aluminum	.....	2.74	Trace	.....	.....	
Chlorin	52.00	47.37	14.17	31.00	51.00	7.29
Sulphuric acid	.....	651.49	104.66	142.40	250.00	7.10
Carbonic acid	.....	216.78	239.60	615.00	530.00	15.30
Silicic acid	.....	16.68	.....	21.65	18.12	7.50
Silica (SiO_2)	78.00	.....	.....	.....	.....	.....
Carbonate radicle	19.00	.....	.....	.....	.....	.....
Bicarbonate radicle	69.00	.....	.....	.....	.....	.....
Sulphate radicle	26.00	.....	.....	.....	.....	.....
Nitrate radicle	0.23	.....	.....	.....	.....	.....
Total dissolved solids at 180° C	308.00	.....	.....	.....	.....	.....
Organic matter	3.90	.....	.....	.....	.....	.....
Total hardness as ($CaCO_3$ calculated)	10.00	.....	.....	.....	.....	.....

MORE COMPLETE ANALYSIS OF WATER SUGGESTED

The theory has many times been advanced that mottled enamel might be caused by a lack of lime in the water, but as shown in the above table, Pictou has fifteen times more lime than has Colorado Springs, yet the enamel is worse at the former place than at the latter. The table also shows that there is no striking lack of lime in any of these districts.

The brown discoloration shown in the photographs has been attributed to the presence of iron, but the table again shows that this element is practically absent, entirely so at Pictou, the most severely afflicted place yet examined. The high acid content of these waters is to the writer the striking feature and suggests the most suspicious possible cause. In connection with the above, the writer has had the feeling that such analyses as these stopped short of a complete determination of the contents of these waters, whereas if a more complete technic were employed, search could be made for traces of the more unusual elements possibly existent therein and such more exact analyses are greatly to be desired.

THE GENETIC CAUSES OF DENTAL ANOMALIES*

By Alfred Kantorowicz

(Professor at the Dental Institute of the University of Bonn.)

NOTHING derogatory to Angle's claims in orthodontics is intended by the statement that although he has promoted the treatment of bite anomalies, and has rendered possible a survey of their many manifestations by his classification, he has not rendered these anomalies more intelligible, if we mean by this that their different stages are made plain as to their origin, development and as to the influences by which such an unusual development is produced. By far the greatest number of these anomalies are not inherited defects but mutations which develop lawfully (similar to the normal development of an organ), a development which takes place through influences which are not to be found under normal conditions. Any anomaly must have grown from the smallest beginnings to the condition in which it presents itself; it should not be difficult, therefore, to show its different stages.

A term of twelve to fourteen years is required for the entire development of any anomaly. Outward circumstances rarely render it possible to get impressions at regular intervals during the whole of this period. Not forgetting the aim just now mentioned, we shall therefore be content to study the various stages of anomalies in different individuals. Some of these stages must even be omitted entirely. In this qualified sense there is as yet no possibility of proving empirically every one of my statements. I may, therefore, be allowed to attempt the genetic interpretation of several abnormalities.

MONOCAUSAL AND MULTICAUSAL ABNORMALITIES

There are but few pure anomalies. Most of them originate in the complex influence of various causes or in a succession of causes. In systematic and didactic respects it is advisable to make conspicuous single successions of causes, thereby depicting "pure" symptoms of anomalies. The result would be a derivation of abstract anomalies. As soon as we have got an idea of these we shall be the better able in a clinical case of an anomaly to keep in view the various components of the complex forms of their manifestation. We shall thereby be spared from assuming outward similarity for inward equality. Take for instance protrusion caused by thumb-sucking in contrast to that which is caused by compression of the upper jaw.

Moreover most anomalies develop (in spite of similar deforming causes) only in those cases in which the child's constitution is favorable to them. Thus there must be internal agents besides the external among which weakness of the bones (that is rachitis) plays the essential part. A great number of anomalies develop on a basis of rachitis, although of course the fact of a

*Read at the Congress of the European Orthodontological Society, 1924.

weakness of the jaw does not sufficiently explain why the individual anomaly just shows this special and typical form. It is to these inner (endogenic) causes in connection with outer agents (exogenic agents), which frequently appear multicausal, that the complexities of the problem are due.

As regards the etiology accepted up till this time, it must be admitted that every author has had his own thoughts as to the development of those anomalies, which were the objects of his daily labor. These thoughts on genetics, however, had according to the practical aim of orthodontic science—much less stress than the therapeutical aspect. The etiological merit of Angle's classification is the severance of Class 2, Sub-division 1, as mouth breathers, and Sub-division 2 as nose breathers. He cannot satisfactorily explain how mouth breathing comes to cause distal occlusion, and still less is he able to make plain how Sub-division 2 develops with normal breathing. The consequences of tooth removal, which make up the greatest amount of all anomalies, are also hitherto insufficiently known in spite of all hints in this direction. Even the "open bite" has as yet never been looked for during its development. Plenty of statements have been made as to the consequences of bad habits of children, plenty of casuistic communications about want of room caused by supernumerary teeth or the consequences of too few. And yet the aim of orthodontia is not to be found in the explanation of the origin of the unusual case but in placing it in a group, not in satisfaction of our etiological exigencies but in the fulfilment of our wish to systematize the world about us.

Out of the number of succeeding causes interfering with the development of the jaw I shall now successively consider:

(1) Consequences of an obstruction in the nose.

(2) Consequences of pressure of the muscles on the jaw in case of diminished firmness of the bones.

(3) Hindrances of growth as a consequence of untimely tooth removal.

(4) Irregularities of the occlusion caused by a slight and probably innate variation of the arrangement of the teeth.

Consequences of an obstruction in the nose.—As a rule the obstruction of nose respiration caused by adenoids (other causes are practically of no consequence) leads to mouth respiration. This is the reason the well-known effects of interception of breath are mostly put down to the account of mouth respiration. As we, however, analyze the causes which interfere with nasal breathing we come to the conclusion that mouth breathing has no influence whatever. The deformation must be brought about by the fact that in case of intereception of the breath, the air is forced to pass a narrow channel, and that in order to overcome this narrowness a stronger respiratory pressure must be effected than is necessary to be produced for normal breathing. When I take my breath through the open mouth there are—as you may see on this manometer—slight balancings to be noticed as well in inhalation as in exhalation. But they wholly compensate each other. Thus even in case of a very strong pressure should be effected in one of the phases of breathing, it would be counterbalanced by the pressure in the reverse phase of breathing. It is otherwise with a child, who breathes laboriously through the nose. The ob-

stacle generally is to be found in the pharynx in form of an adenoid growth (Fig. 1). Behind this narrow passage a stronger negative pressure must be effected in order to suck the air through it. This pressure is exerted against all sides of the respiratory channel. These are: (1) the chest where the well-known inhalation-hollows form themselves, and where in the end the concave shape of the thorax results (Fig. 2); (2) the cavity of the mouth, because in this consideration it must be regarded as a by-cavity of the respiratory channel. In case, therefore, that laborious breathing through the nose takes place, the soft parts of the mouth-cavity lay themselves on those parts which lie immediately underneath with a greater or lesser pressure. These parts are represented especially by the teeth, upon which they produce a pressure that has the effect of compression in and from all directions. This is easily made plain. We need only try to breathe with closed lips and nose. In paying close attention we then feel how the cheeks press against the teeth with considerable force.

The question then arises: Is there no counterpressure (in the form of an expansion) caused by the air being pressed out through the narrow passage, which again might only take place by renewed strong compression. But in putting this question we overlook the fact, that for inhalation only one way was open, whilst for exhalation there are two: first, through the narrow passage in the pharynx, secondly, through the mouth with a slight lifting of the lips. A sleeping child with an obstructon in the nose lets the air out of the mouth by jerks. There is, therefore, no possibility of a counterbalancing pressure of expansion taking place. In a case of laborious nose breathing there is thus a one-sided compression to be ascertained which is not counterbalanced by a counter pressure (in form of expansion), and which works up on the sides of the mouth cavity. When the obstruction becomes so big as to make impossible any breathing through the nose, mouth breathing sets in when the deforming influences cease. It is thus not mouth breathing but laborious nose breathing which has a deforming effect.

Compression of the jaw on all sides works characteristic changes upon it. An ellipse loaded on all sides grows longer, the jaw is thus compressed and protruded (Fig. 3). The protrusion is thus a consequence of compression. There can be no doubt that this protrusion can only manifest itself where all the teeth are present, because it depends on a transference of the pressure from the sides to the front by the teeth. Thus where a tooth is wanting, the front parts remain in their place and are not protruded, but the gap closes; retrusion as a consequence of compression is thus always characterised by a serried arrangement of the front teeth, whilst in case of protrusion caused by thumb-sucking, gaps form between the front teeth (Fig. 4). By this difference the two kinds of protrusion may easily be kept asunder. Protrusion in the lower jaw either does not occur or is less pronounced, because the lower jaw with its compact structure is less easily compressed, and protrusion is the consequence of compression. In a case of pressure on all sides against the lower jaw there occurs pressure towards the front as a component of compression exactly as we found in the case of the upper jaw. The compression component can only work upon the lower jaw, because the upper jaw is connected

with the skull by many solid bones, whilst the lower jaw hangs loosely in its joints. During the time of growth it is more easily able to adjust itself to the deforming agents than the upper jaw, and is much more subject to distal shifting. As we are well aware that but a slight distal shifting is wanted to produce distal occlusion in the place of cusp occlusion at the moment of erup-

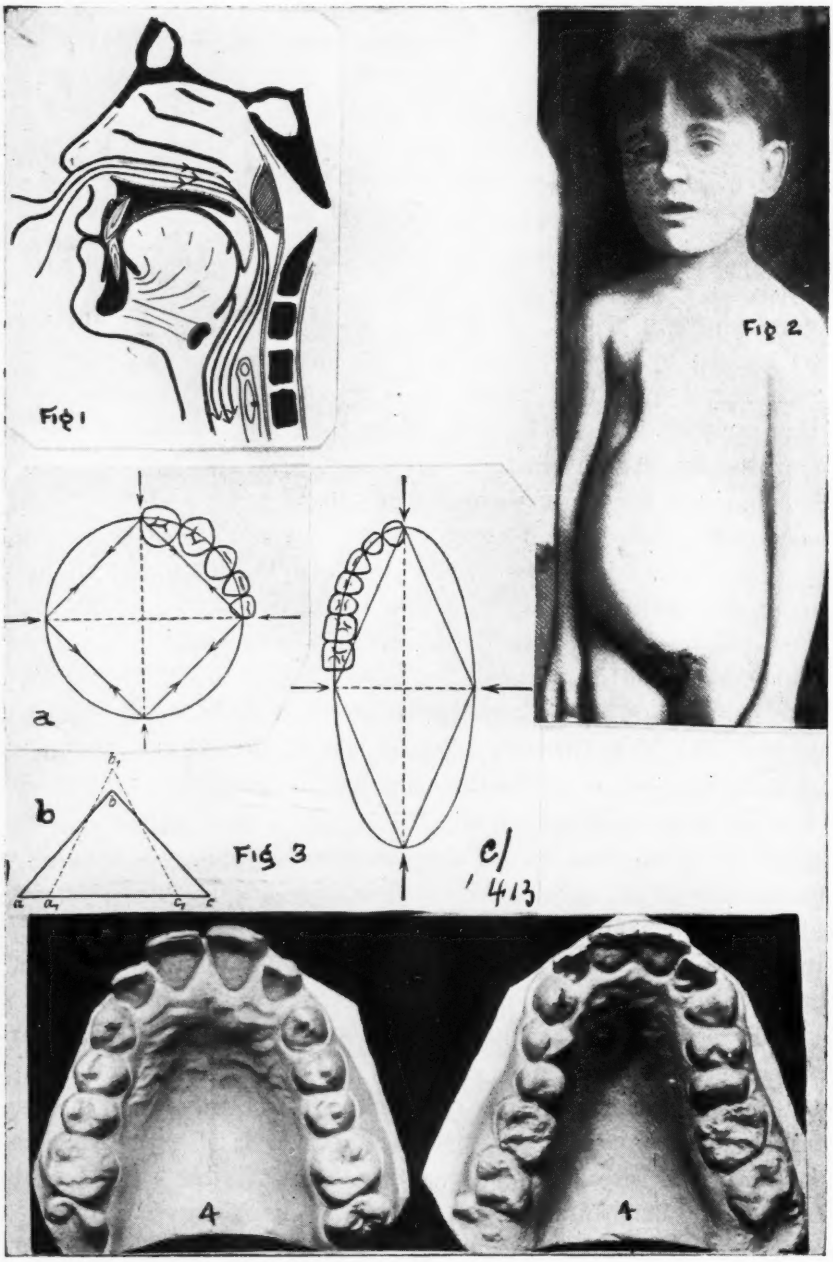


Fig. 1.—Narrowness of the respiration channel caused by adenoids. Behind the narrow passage a stronger negative pressure exists in inhalation.

Fig. 2.—Concave shape of the thorax as result of adenoids.

Fig. 3.—(*a*) Circle on all-sided compression. (*b*) Sketch of compression of the jaw. (*c*) Ellipse on all-sided compression.

Fig. 4.—Protrusion caused by thumb-sucking (gaps between the front teeth) and protrusion as a consequence of compression (serried front).

tion of the first molar, we shall put down the origin of distal occlusion to this period of the eruption of the first molar.

All agents which cause a negative pressure in the mouth are to be looked at as analogous to obstruction of the nasal passages. To be mentioned first is the use of the comforter or the sucking of a finger—generally the thumb—by babies, both of them being consequences of artificial nutrition. Natural nutrition of the sucking child represents rather a chewing at the breast, that is the squeezing of the breast, while the bottle requires to be sucked. It must be admitted that often artificially nourished children possess less resistent jaws than those fed at the breast, leaving undecided the question if pronounced rachitis really is always a factor. Thus deformation by increased negative pressure may be found even in babies' jaws, that is at a much earlier age than has been supposed. Deformation by sucking, in the artificially nourished child, is not to be separated from the deformation caused by pressure. The comforter, incessantly kept in the child's mouth, by degrees curves the jaw upwards relatively. Accordingly we find the "open bite" even much earlier than was generally suspected, even in the toothless baby, discernible by a greater incurving of the occlusal plane.

I shall now show by a succession of pictures how deformation caused by sucking or by pressure presents itself at the earliest infantile age (Figs. 5, 6, 7).

From these pictures, which have been chosen from a series of seventy rachitic children (these were the inmates of a home for healthy children), we gather: Firstly, the deformities are discernible far earlier than the general opinion holds. Secondly, it is possible to find a successive order of stages in the development of an anomaly (with every by-phenomenon) up to distal occlusion. By this series the etiology of the acquired form of distal occlusion may be looked upon as ascertained. Thirdly, open bite is also a deformity of babyhood, or at least it is demonstrable even in babies' jaws (Fig. 8).

Out of the number of deformations caused by muscle-strain there must be considered the deformity occasioned by the chewing muscles, which manifests itself in the obtuseness of the jaw-angle and in the flexure of the chin, of which characteristic instances are to be seen in the illustrations. The obtuseness of the jaw-angle, it is true, is not to be demonstrated in the baby jaw, because a proper jaw-angle does not yet exist, and because the shape of the baby jaw is yet too vague to allow measuring. But in spite of this the deformation of the jaw-angle is immediately proved by the obliquity of the occlusion plane of the lower jaw, which in the upper jaw manifests itself in a tremendous compensation curve. The angular arrangement of the chin area, which also occasionally favours the projection of the upper teeth in advance of the lower ones, is to be immediately connected with the strain of the upper tongue muscle, and has always been known as a characteristic symptom of rachitis.

Hindrances of growth as a consequence of untimely tooth removal.—We now pass to an important factor, the untimely removal of teeth during the growth of the jaws. The harmful period is between the fourth and the twelfth years of age. Even these consequences are known, and have been investigated by Angle and Grünberg. However, the disturbances and effects have not been sufficiently described. It represents the most frequent cause of bite anomalies

and appears in combination with all other anomalies. Because weakness of the bones as a consequence of rachitis causes a weakness of structure and thereby early caries of the remaining teeth, it is mostly to be found in combination with open bite and with the distinct cases of jaw compression with distal bite.

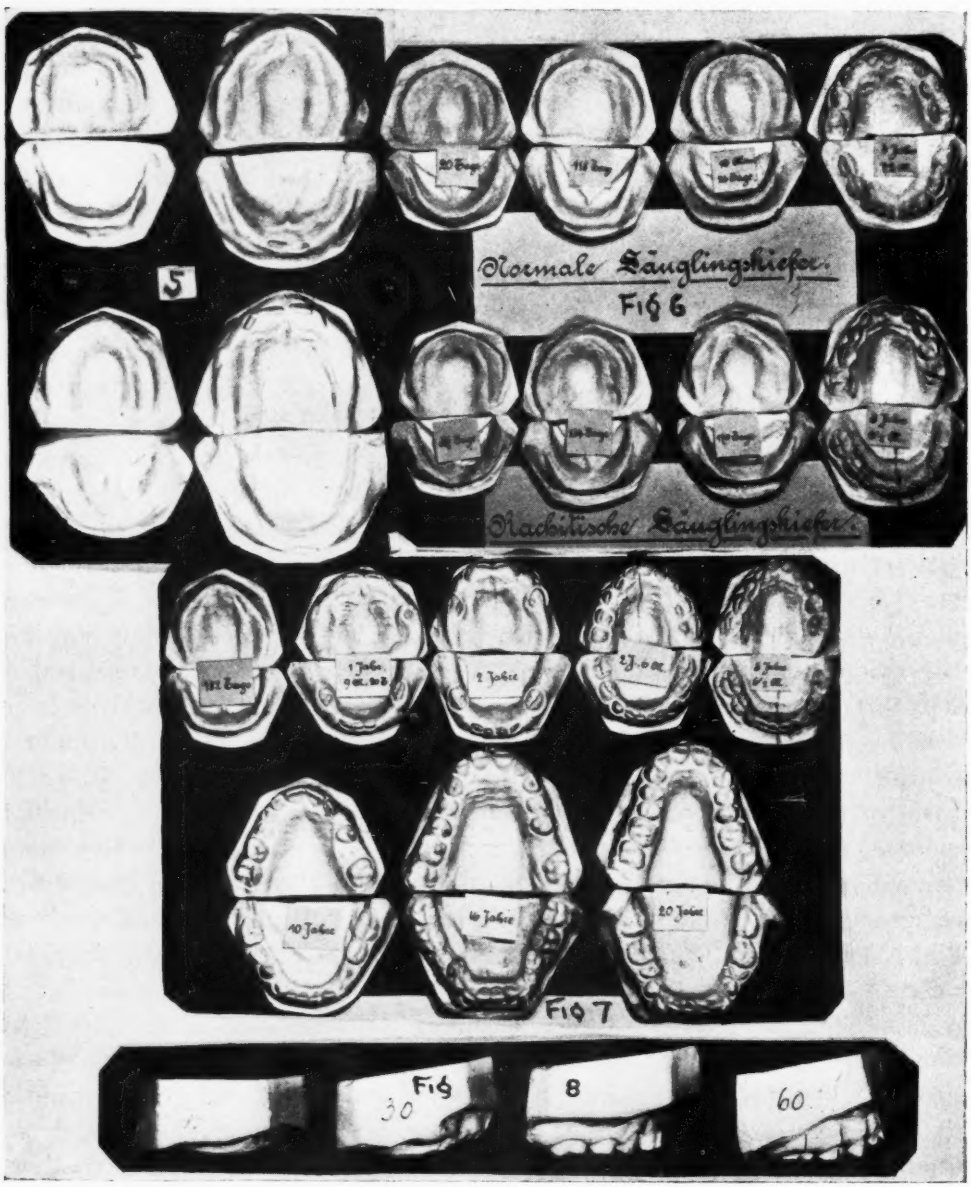


Fig. 5.—Deformed jaws of four rachitic babies.
Fig. 6.—Normal and rachitic jaws of children.
Fig. 7.—Development of the rachitic jaw.
Fig. 8.—Great compensation curve of the plane of occlusion demonstrating the beginning of open bite at baby age (first and third are normal for comparison).

In this Society I may, perhaps, abstain from deducing the laws which decide on the untimely removal of teeth. I shall rather name and exemplify them. The first law runs thus: When a tooth is removed before the jaw has

attained its full growth and the gap closes, the teeth in front of the closed gap stand mesial against the sound side or against the sound opposite jaw. Practically the loss of the six-year-molar or the second milk-molar and of the cuspids need especial consideration. It is best to divide growth into three periods—from the sixth to the eighth, from the eighth to the tenth, and from the tenth to the twelfth years of age, as first, second and third periods of growth. In these six years the jaw grows forward by the space of the twelve-year-molar. In case the six-year-molar is removed, the twelve-year-molar, moving forward and upward, does not push the row of teeth before it, but simply moves into the gap, which was formerly filled by the six-year-molar. Every one of the teeth in front of the gap remain in their old places, whilst in the sound side they move forward by the breadth of one tooth. In case now the teeth, from the premolar on, are arranged more distally on one side than on the other, generally the more distal teeth have not moved forward; it occurs but very rarely that the premolar and the molar move forward together (Figs. 13 and 14). Thus, when the gap of a cuspid is closed, as a rule the front teeth are arranged too far distally.

Further, there may be deduced from this law the shifting of the middle line, a shifting which to my knowledge has as yet found but a rather insufficient and incomplete explanation. One side being obstructed in its growth and the other growing forward, the middle line must shift towards the injured side. Thus a glance at the middle line is in the greatest number of cases sufficient to make out at what time the removal of the tooth has taken place, i.e., in the first, second or third period of growth. I need not mention that this is only the case when we have to deal with one-sided closing of the gap. The shifting of the middle line appears immediately in these sketches; it is conspicuous also in the so-called pipe experiment. The second law runs thus: If a tooth is removed after the termination of the jaws' growth, or in the third period of growth of the twelve-year-molar, and if the gap has closed, the teeth behind the gap stand mesial against the sound side or against the opposite jaw. The third case, in which a tooth is removed during the second period of growth (i.e., between the eight and ten period of age), shows as a result tooth shifting, which comes between both extreme cases. The teeth have a wrong arrangement in front of the gap as well as behind it.

Let me now look at some anomalies which result from obstruction of growth, and let me try to explain their origin. Whilst the hitherto stated causal connections are already so well ascertained that they may not be doubted (even if their influence demands further elucidation in many respects) the origin of Angle's third class of mesial bite is yet rather involved in obscurity. Looking for this third class in babyhood or in childhood we shall find that our research is hopeless (Fig. 16). We meet with a protusion of the lower incisors, the mutation character of which is yet wholly unexplained, and which probably represents a variation of a nonhereditary nature. How does it happen that from this protrusion of the incisors, which always belongs to Angle's first class, the third class results? The manuals of orthodontia pass this question over in silence.

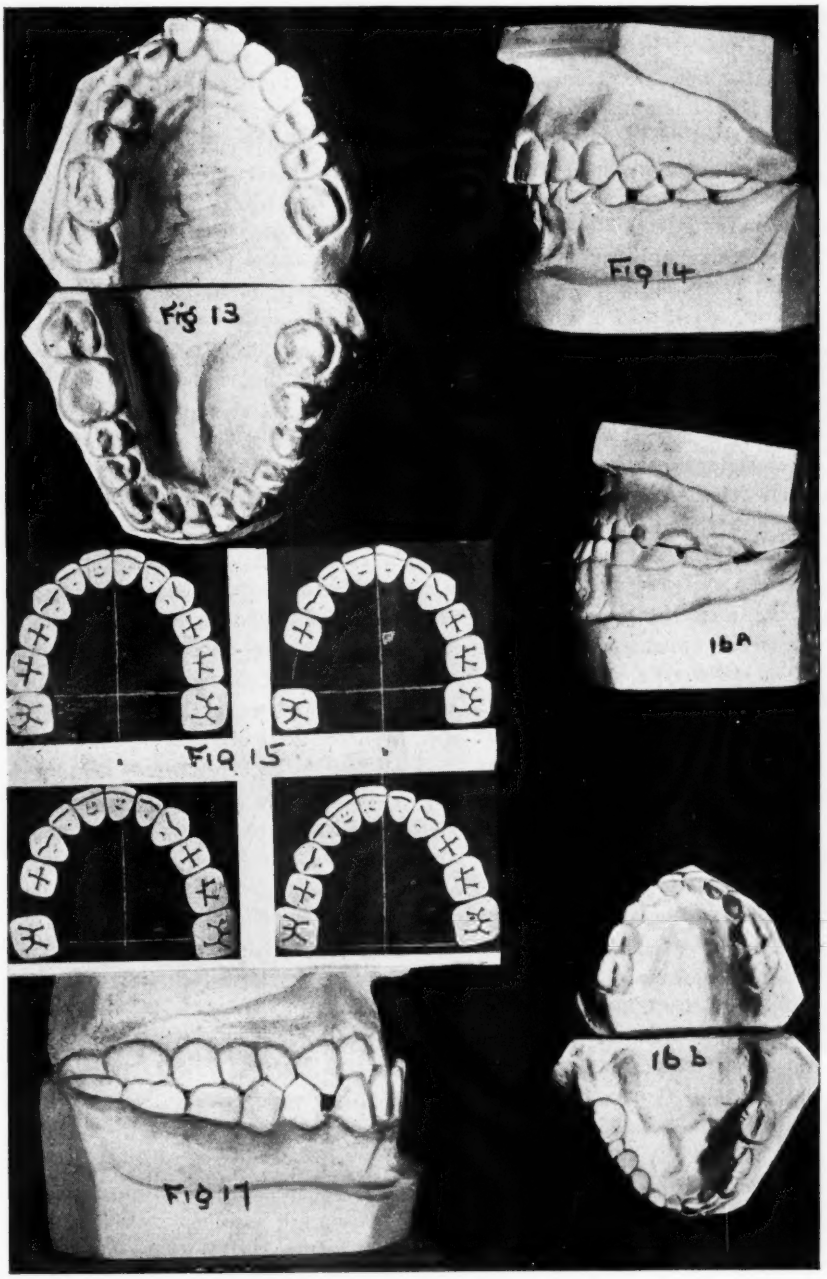
Some hints are to be found in occurrences which take place during the

shedding of the front teeth. It is well known that about the fourth year of age gaps form between the deciduous teeth which occasion a widening, but also a lengthening of the upper jaw. It is also known that this lengthening allows the lower jaw to move a little forward and the cusp occlusion of the first molar to enter into the occlusion of the fissures. In case, however, these gaps are formed while the lower jaw is kept in a forced situation in front of the upper incisors it moves forward, compelled by the movement of the upper teeth. This moving is corroborated by the greater labio-palatal diameter of the re-

Fig. 9.—Obtuseness of the jaw angle by m. masseter.
Fig. 10.—Open bite of a patient of 20 years.
Fig. 11.—Profile of patient's face.
Fig. 12.—Illustrating hindrances of growth caused by untimely tooth removal.

maining incisors in comparison to their forerunners. They even force this compulsory movement and thus help to drive the lower jaw to the mesial bite. This new occlusion is, of course, only secured by the interdigitation of the premolars which fixes the occlusion in the mesial bite. Occasionally it is only the lower front teeth which follow the mesial shifting; the result thereof is to be seen in gaps between the cuspid and the premolar (Fig. 17). I cannot as yet give an unbroken series of instances for this explanation of the mesial bite. The truth, however, will probably be found not to be far from this

hypothesis, which is well-founded on single instances. I regret not to be able to give a sufficiently founded hypothesis as to the origin of Angle's Class 2, Sub-division, because the few cases which I was able to study from earliest childhood suffice but to give hints for further investigation. The practice of orthodontia has outrun theory. But I am convinced that also therapeutics will receive many valuable hints from thorough etiological research.



Figs. 13 and 14.—Consequences of the removal of the left six-year molar.

Fig. 15.—Shifting of the median line caused by the removal of the right second milk molar at six years of age.

Fig. 16.—Mesial bite in baby age.

Fig. 17.—Gap between the cuspid and the premolar illustrating the mesial shifting of the lower front teeth.

DISCUSSION

The President said the members had heard a very interesting paper from Dr. Kantorowicz. Dr. Kantorowicz had presented some theories which were not entirely the same as those to which the members were accustomed, and he was sure that some of them, whose theories were different from Dr. Kantorowicz's, would like to discuss the paper.

Dr. W. C. Fisher congratulated Dr. Kantorowicz upon his paper. To his mind Dr. Kantorowicz's slides, and his work on the impressions of the infant jaw prior to the eruption of teeth, were beautiful. D. Kantorowicz had opened up a subject for serious study. Personally, he did not think orthodontists had given enough attention to the study and development of the jaws of the infant prior to the eruption of the first teeth. It was remarkable how Dr. Kantorowicz had been able to point out the effects of rickets in jaws before the teeth appeared, so that it could be visualised what the deformity was going to be. If it could be possible in an orphan asylum for an orthodontist to be allowed to take impressions and study the same children over a period of years, he would arrive at something even more valuable than what Dr. Kantorowicz had put before the meeting that morning. Dr. Kantorowicz had shown orthodontists what they could learn from that particular study, and if they would take it in a truly tabulated scientific way from a child at birth, or a few weeks old, up to the eruption of the permanent teeth, they would then have data which would be of great value. He did not suppose that Dr. Kantorowicz made his diagnoses purely and simp'y from his plaster models, but used his photographs along with those models, because some of the cases which Dr. Kantorowicz had shown—in particular the one which was called the anterior protrusion of the mandibular incisors, and Angle Class 1—could not possibly be diagnosed from a plaster model; there must be photographs. So far as the causes of many malocclusions and extreme cases were concerned—similar to the ones which Dr. Kantorowicz had shown—it was impossible to make a correct diagnosis of any character without not only photographs but an absolute medical history of the child from birth and also of the child's parents. With regard to Dr. Kantorowicz' statement that the third class did not appear in childhood prior to the fourth year, he must take exception to that. Class 3 could be diagnosed and could be found, and was diagnosed and was found, in infants as early as two years.

Dr. A. L. Lockett desired to say how much he, and he was sure all the members, appreciated the amount of time and work which Dr. Kantorowicz must have devoted to the subject dealt with in his paper. It must have been an extremely big task to have prepared the slides and the models, and a paper of such length and interest. He did not desire to raise any criticisms on the paper but merely to express his appreciation, and that of the other members, of the trouble and effort which Dr. Kantorowicz had shown in preparing his paper and bringing it before the Society.

Mr. G. Northcroft thought that one important point which had been brought out in the paper was the great importance and desirability of endeavouring to arrive at the cause of some of these malocclusions. If there was one thing which had been brought out quite clearly (although he did not entirely agree with it), it was that if those conditions were brought about by rickets, then in that case it was very patent that orthodontists should start treating the rachitic condition at a very early period of life rather than to attempt orthodontic treatment. That was a point on which, as practical orthodontists, they should lay stress, and it proved once again the great value of delving into the causes of those malocclusions, because if they arrived at the cause, they could then logically arrive at the correct treatment.

The President said he sincerely admired the work which Dr. Kantorowicz had undertaken. He knew personally how difficult it was to prepare a paper, especially with a great number of slides, and how many years of work it involved to get anything together such as Dr. Kantorowicz had shown that morning. He did not want to mention all the points on which he agreed with Dr. Kantorowicz, as there were too many of them; but there were a few points on which he disagreed, and those were the only ones which he would expose. Concerning mouth breathing and nose obstruction, he understood that Dr. Kantorowicz considered them—in fact it was the accepted thing—as being causes of malocclu-

sion. Personally, he was not sure that mouth breathing was always a cause; he thought sometimes it was a consequence. The members knew, from the work of Dr. Weinberger of New York, that very often they found what could be termed Class 2 cases, or, more exactly, retrusion of the mandible, in children at birth. Sometimes they found such cases before birth, due to the position of the foetus in the uterus, as had been shown by radiographs by Weinberger. Therefore it could not be said that those cases were due to mouth breathing, but mouth breathing was bound to occur, because the lower jaw, being too far back, the tongue had not sufficient room to place itself in the mouth, and it was forced back. That was what Pierre Robin had called glossostosis. It was a falling back of the tongue, which naturally obstructed the respiratory tract, and obliged the child to open the mouth. Therefore in that case the mouth breathing was not at all due to nasal obstruction, but was due to a misplaced lower jaw. It was a point which he desired to bring out, because although perhaps nasal obstruction and mouth breathing might cause malocclusion, still in some cases malocclusion was the cause of nasal obstruction and mouth breathing. What he had just said would seem to disprove to a certain extent that the age at which distal occlusion appeared was the age when the child cut its first molar. Malocclusions of all sorts were found in children young enough not to have their first molars—in children who had only their temporary teeth. Skulls showing that could be seen in Professor Bolek's museum. He was not prepared to discuss the presence of open bite in toothless babies. He had not had any cases like that in his practice, and he had not had the occasion to see many toothless babies, so he could not state how often open bite was visible; but a picture had been shown by Dr. Kantorowicz of rachitic jaw with compression. In that picture the compression was unilateral. He had noticed that one side was almost normally developed, and that the compression occurred upon the right side of the jaw. Dr. Kantorowicz had said that it was due to muscle compression. Personally he wondered whether in that case a condition had not to be dealt with such as had been described by Stallard, who thought that cases of unilateral compression, or unilateral lingual occlusion, were due to such things as sleeping on one side—always sleeping on the same side with, for instance, a hand under the head, or a pillow on one side. Personally, he had come across a very few cases like that in his practice in which that perhaps might have been the cause; he could not say for certain because he had not seen enough, but he wondered if it might not have been the case in the picture which Dr. Kantorowicz had shown. The compression there was unilateral, and he should think that muscular compression would act equally on both sides. One thing had troubled him very much in what Dr. Kantorowicz had stated, and that was what Dr. Kantorowicz had termed the first law relative to extraction of the teeth, in which Dr. Kantorowicz had said that the teeth on the injured side remained in their same position, while on the normal side they moved forward in conjunction with the teeth of the opposite jaw. He wondered how Dr. Kantorowicz could prove his point. If he could, then he would be convinced, but it seemed to him that there had simply been a shifting posteriorly of the teeth medially to the incisor teeth. That was the way in which it appeared to him from the slides, and especially what made him say it was the shifting of the median line. He hoped Dr. Kantorowicz would not think he was finding any fault with the paper. On the contrary, he had found it most interesting, and, as he had said, he did not want to emphasise all the points on which he agreed, as he did not believe that was the right way to discuss a paper. He thought the right way to discuss only those points on which there was disagreement. He desired to thank Dr. Kantorowicz for the trouble and time he had spent upon the paper.

Dr. Kantorowicz, in reply to Dr. Fisher, said that orthodontists in Bonn had always tried to make a series of impressions, as they had a somewhat large clinic for school children there. They took from interesting cases impressions in the sixth year and followed them right through. It was very difficult to follow the history of the parents, as those children were illegitimate. He quite agreed that one could not make a diagnosis from the model to which Dr. Fisher had referred. His intention had been only to give a succession of causes, and not to make a diagnosis. It was only an example and an explanation. He was thankful to Dr. Fisher for his statement that the third class was found in early

childhood. He had never found it in early childhood—not pronounced third class. It was, of course, possible to find it in early childhood, but in that case the lower jaw of the baby must be prognathous to the upper jaw by 1 mm. That was very much for a little baby. It was very much for a grown-up subject, and for a baby it would be an abnormal monstrosity. It was, of course, possible for such monstrosities to be born, but he could not believe that a third class was found generally in early childhood. He did, however, think that the third class developed from the first class. That class developed from the normal condition, and some influences during the early childhood developed into the third or into the second class. With regard to nose obstruction and glossostosis, it must not be thought that he had given all the succession of causes. Naturally there were many successions of causes, and that rendered the etiology of malformation very difficult. He had only mentioned some characteristic causes. Mouth breathing was not a cause of deformation. If there was an impression during inhalation there was an expansion during exhalation, so there could not be a deformation. A deformation could only take place if there was a compression on inhalation which was not counterbalanced by an expansion on exhalation. He could not agree with the President that sleeping on one side gave rise to cases of unilateral compression or unilateral lingual occlusion. With reference to the first law to which the President had referred, one had no firm point in the skull. One could not say that one tooth had remained in its place and another had moved. Exactly the opposite might be said. He could not say the earth was moving and the sun was standing still; he might equally say the sun was moving and the earth was standing still. It was much more difficult to propound such a theory, of course, because then one came to conclusions which were very difficult to prove, but in modern times, with the theory of relativity and time, it was no more nonsense to say that the sun stood still and the earth moved round it as it was to say the opposite. So it was equally true to say that the gap stood still and the teeth behind the gap came forward, as to say that it grew in front, or to say that the teeth before the gap moved backwards. He could say both. They had a child nearly 7, and knew that teeth before the gap should move backwards. Why should they move backwards? There must be a compression to move them backwards. There must be a force which moved them backwards. They could not find a force in a normal case. It was much simpler to make the hypothesis that the jaw did not grow forward.

THREE CONTRIBUTIONS TO ORTHODONTOLOGICAL DIAGNOSIS*

By Dr. V. Andresen, Copenhagen

I. Fixed points and planes for comparison with gnatho-physiognomical alterations.

II. Gnatho-physiognomical photographs.

III. Malocclusions belonging to Bolk's "Zukunftsgebiss" as new classes or divisions in the orthodontological system.

I. *Fixed points and planes for comparison with gnatho-physiognomical alterations*

Artists have been the first to try to design fixed points and planes of the human body—especially of the head—regarding the anthropological proportions and alterations which they undergo during progressive and regressive metamorphoses.

Regarding planes suited for our purposes, most of our authors are yet in a state of uncertainty—some using anatomical fixed points and planes, and others physiologically placed but not fixed points. To unite these two different methods, and join the advantages of them, seems to be the best solution of this question. We thereby have the advantage of comparing the topographical relations of the changeable and fixed planes at the different stages of growth and change by orthodontic treatment.

It is, however, necessary to collect a great number of different cases before we can draw any conclusions concerning the rules for diagnosis, therapy and prognosis depending on the ethics of physiognomical art.

As a diagnostical fixed point or axis of the head for comparison during the growth, and for judging and demonstrating the changes which we attain by our treatment, the author would like to introduce the axis through the labyrinths. Reflections upon this point are as follows:

(1) It must be mentioned that, although a fixed point cannot be found in an anthropological sense, this is quite otherwise in relation to orthodontology, which is not a variety of anthropology but rather an "individuology."

(2) The head is constantly in a stable equilibrium. It is, therefore, probable that the head must sustain this equilibrium during the growth by developing in, so to speak, all directions from this axis.

(3) This axis must be said to be fixed by the function of the organs which control this equilibrium.

(4) In the circumference of this axis we easily notice a distinct point on the surface, viz., tragion and, further, the condyles, both of which points are very useful for our intentions.

*Presented at a meeting of the European Orthodontological Society, Amsterdam, August, 1924. Revised January, 1925.

Some few Figs., Nos. 1-5B, will do more than many words of explanation. Although these results are very attractive, this method of demonstration can be improved by systematising, in that we may combine it with a photo-static method similar to Simon's,[1] as represented later on.

II. *The production of gnatho-physiognomical photographs*

In spite of different trials regarding the reproduction of topographical and anthropological relations between the jaws and the features, we have not as yet both a practical and useful method for orthodontological diagnosis. Van Loon[2] was the first who showed some excellent results by an original anthropological method similar to Figs. Nos. 6 and 7. This method, which was too troublesome, has however been very successful, in that it has inspired many experiments. Körbitz demonstrated, on the occasion of an orthodontological course at Copenhagen, in September, 1922, a very quick method, which is shown in Figs. Nos. 9 and 10. The principle in Fig. 9A, 10A and B consists, according to Körbitz, in the placing of the casts in such a way that the negative impression of the face gets no light on it, so that the models are seen in a sort of silhouette, also in the photographs. Amongst other methods of judging the gnatho-physiognomical relations may still be mentioned that of Tryfus.[3] The mutual antagonisms of the different authors is an infallible proof that no one has, as yet, elaborated an approximately satisfactory method. The first attempts of the author are shown and explained in Figs. 11-12.

The method of Körbitz and the photo-static and gnatho-static method of Simon[4] stimulated the author to seek a convenient method of producing gnatho-physiognomical photographs, which he had the honour to demonstrate to your Society. The gnatho-physiognomical photographs, which have a great diagnostic value, are made by a very simple method. The models must be shaped in a systematic, artificial manner. Then place a piece of impression compound between the occlusal surfaces of the molars and premolars in the left side. Having shaped the resulting impression to suit the models, with the teeth in occlusion, one only needs to try it in the mouth and replace it on the models. Then bend a piece of metal wire to a right angle (frontal-saggital) and fix one of the ends, by heating it, to the small bucco-occlusal impression, so that the wire will pass between the lips at the angle of the mouth. Both ends of the angle must be parallel to the occlusal plane, the outer (frontal) end pointing at the right side. It still needs a small ruler with a hole in the middle, so that it can be fixed on the outer (frontal) part of the angle, just in the median plane of the head.

It is easily understood that it is possible by this little instrument (gnatho-physiognomical indicator), which is made quicker than it is explained, to make two exposures in the same tri-dimensional orientation—first, of the head of the patient with the indicator *in situ;* secondly, of the models also with the indicator. It is only necessary to fix a photo-static rod (after Simon) to the photographic apparatus parallel to its longitudinal axis, and place the apparatus in such a way that the photo-static rod is in the same relation to the indicator in both exposures. It is thus evident that the indicator and the ruler, which are noticeable on both plates, serve for the placing of the plates in the right rela-

tions, in order to show the models projectionally in the face. It is further evident that one is able to make a perfectly similar photograph years afterwards, by means of this arrangement, if only the apparatus be systematic in all details. This method gives very satisfactory results, as shown here, regarding comparisons with the gnatho-physiognomical relations before and after treatment or when studying the changes of growth.

III. *Malocclusions belonging to Bolk's "Zukunftsgebiss"*[5] *as new classes or subdivisions in the orthodontological system*

The progressive (and regressive) variation of the human set of teeth has a very important interest for orthodontologists. This, so to speak, biological etiology of malocclusion has, however, formerly not been considered according to its importance, and there has not been, in a diagnostic sense, the necessary precautions in the variations of malocclusion, which this factor affects and complicates.

Leaving aside the so-called "atavistic" phenomena, which we intend to treat later on, we shall only mention here the phylogenetic, noninherited reduction, which, as a rule, is combined with progressive development of the brain. Prof. L. Bolk, director of the Ontleedkundig Laboratorium, Amsterdam, has especially examined and treated the reduction of animals and humans, and called it the "terminal reduction" just because it is the first or last tooth of each class—incisors, premolars and molars in the permanent set—which disappears. Most remarkable it is that the hindermost deciduous molar persists and transforms into a permanent molar when the germ of the posterior premolar is not developed.

The theory of Bolk is briefly as follows (deciduous teeth are written with small letters, the permanent with capitals; deciduous molars which are transformed into permanent molars with small letters bracketed):

The formula of a present-day set of teeth:

i. i. c. m. m.
I. I. C. P. P. (m). M. M. Upper and lower jaw.

First reduction:

i. i. c. m. m. In the lower jaw perhaps I. I. disappears.
I. C. P. P. (m). M. M.

Second reduction:

i. i. c. m. m.
I. C. P. P. (m). M.

Third reduction:

i. i. c. m.
I. C. P. (m). (m). M.

Human precedants had the following formula:

i. i. c. m. m. m.
I. I. C. P. P. P. M. M. M.

Thereupon a reduction with disappearance of the third molar took place, whereby the formula became as follows:

i. i. c. m. m. m.
I. I. C. P. P. P. M. M.

This combination is a fact with the small American apes *Arctopitheci.*

Bolk's museum (built upon the site of an old churchyard, wherein some 50,000 skeletons were dug up, these being specially examined and catalogued according to all possible alterations regarding the teeth) has been visited by the author several times, and he has studied the most interesting specimens. It is a unique collection of human and simian skulls, among which there are several with regressive and progressive variations. Bolk's theory is especially based upon this collection and embryological studies. Bolk's latest examinations, which also have great interest for orthodontologists and which Dr. G. Lind, of Amsterdam, brought forward in the discussion after the author's lecture, treat of the development of the chin in monkeys and humans. This theory can briefly be explained by the following extract from Bolk:[6] "By comparing two final forms—which has been the practice so far—and by alluding only to the projecting and receding chin, the problem was put as follows: To what cause should be attributed the development of the former from the latter form? But if, instead of taking contrasted final conditions, one compares processes of development, the number of questions increases owing to the greater quantity of variations of forms and manners of transformation in the different primates."

There is a remarkable divergence between the processes of development of the lower jaw in man and the anthropoids. The infantile type is the same, but whereas the jaw of anthropoids assumes the more primitive type—becoming "more ape-like"—in man the jaw develops to the highest type and becomes, therefore, "more human." The chief cause of this phenomenon is that the deciduous teeth with the apes are comparatively smaller than the permanents, whilst with humans the difference is not so marked. We shall not go further into this question here, but only add that Bolk, besides other things, determines the difference in the second dentition with apes and humans as the cause of the presence or absence of the chin. An interesting phenomenon is the progressive development of the brain combined with the reduction in size of the jaws. Orthodontologists have special conditions for contributing to the solution of these problems. The atypical incomplete reduction as a biological cause of malocclusion has, however, at present not been treated according to its importance. Individuals with a wholly "normal future set of teeth" are probably very rare, but the different stigmata, which belong to the reduction, are on the other hand pretty frequent, and show a tendency to hereditary progression, which one sometimes has the opportunity of observing. The author, who has at his disposal a material of about thirty cases of typical reduction (partly asymmetrical), draws attention to the gnatho-physiognomical illustrations, Figs. Nos. 24-33.

As the publication of this paper has been delayed for different reasons, the manuscript has, in the meantime, been revised and provided with a careful summary of cases from a five years' practice as an orthodontist. To this summary is to be said, that a greater part of the models Nos. 400-701 which are mentioned here are models of such young individuals (from three years of age) that it is not possible to substantiate any probable anodontia. The models have been taken regularly as they came, and have not been selected. There are nine-

teen female to only five male cases, perhaps due to the fact that parents are more careful with their daughters than with their sons. Roese[7] came to the following conclusions on the basis of a very great number of examinations:

"(1) The reduction of the lateral incisors in the upper jaw and the wisdom teeth is based on racial causes, and not on the reduced size of pathological degenerated jaw-bones.

CONTRIBUTIONS TO ORTHODONTOLOGICAL DIAGNOSIS

Fig. 1. A nearly "ideal" skull in *norma lateralis* (external meatus used as the focal point) compared with that of a newly-born infant (negative).

Abbreviations: CP, Camper's Plane; FH, Plane of Francfort; SOP, Simon's Orbital Plane; KFP, Körbitz's Frontal Plane, through Naison, Alare and eventually Gnathion; KHP, Körbitz's Horizontal Plane from Alare at a right angle to KFP; OP, Occlusal Plane, which, in case of the 24 front teeth, is parallel with CP.

Körbitz's frontal plane, which has, as yet, only been treated in demonstrations by this prominent orthodontologist (e.g., in Copenhagen, September 22nd) needs a few words of explanation regarding the idea of it. The following is based on a private letter.

Körbitz says that the skull is an object which cannot be measured and judged tri-dimensionally as other objects, it being unsuitable for geometrical methods.

Körbitz wants to analyse the skulls on a static-functional basis and to this purpose seeks the lines and planes, which will spontaneously become evident from the construction of the skull in question.

Körbitz believes to have found such a "natural" frontal plane by following the most charged points of function. As, however, no "ideal" skull is to be found—at least not in the miscegenerated Europe—one dare not expect to find that three points are in one line, not even on so-called "normal" skulls. It is, however, in accordance with the idea of the (trajectorial) construction—at least of "ideal" skulls as Fig. 1—that Nasion, Alare and Gnathion are found in the Körbitz frontal plane.

Körbitz contrives with the aid of a line at right angles to the KFP drawn from Alare, to get an idea of the joint and the occlusal plane in relation to the KFP.

As already mentioned, the author cannot agree either with the anatomists or with the physiologists singly. It is necessary to compare the changes in the mutual relations of both the relative invariable and the changeable points, lines and planes, as demonstrated in the following Figs.

Fig. 2A, No. 413. Disto-occlusion, Cl. II, 1. Abnormal lip function. Boy at the age of fourteen and again at seventeen and one-half years, before and after treatment.

Notice that the vertical lines answering to KFP and SOP as the result of the treatment are approaching each other at the Gnathion, as is also the case

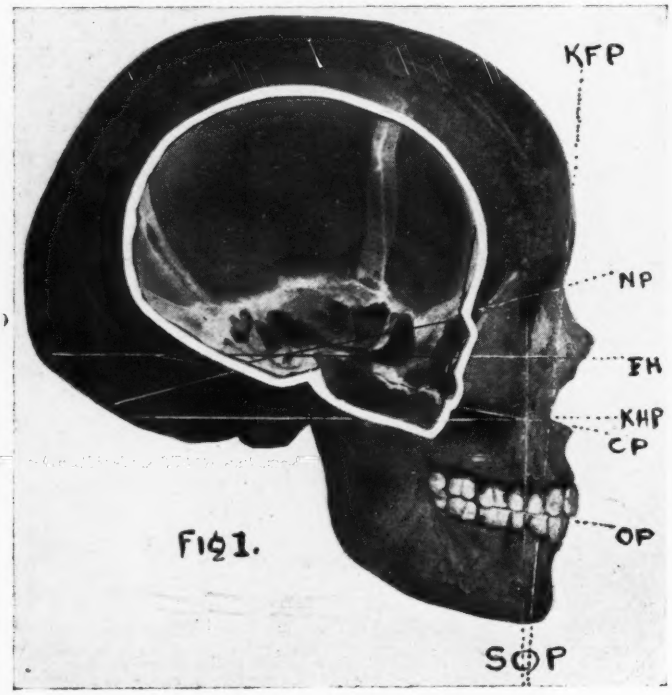
in the following Figs. The relations become similar to those on the "ideal" skull.

Fig. 2B, No. 413. A positive and a negative plate, as the former, placed together, so that porus acustic. ext. and Camper's plane are corresponding, to show the changes by growth and especially by the treatment.

Fig. 3A, No. 358. Disto-occl. Mouth-breather. Boy at the age of ten and again at thirteen years.

Fig. 3B, No. 358. Comp. with the former Figs.

Fig. 3C, No. 358. Two photographs showing the boy at the age of ten and fifteen and one-half years, about three years after ending the treatment. Notice that KHP is now fully corresponding with Camper's plane. Comp. with



former Figs. and notice that the changes introduced by the treatment progress afterwards.

Fig. 3D, No. 358. *En face.* (The left eyelid injured afterwards.)

Figs. 4A and B, No. 387. Disto-occl., Cl. II, 1. Mouth-breather. Girl thirteen and seventeen and one-half years.

Figs. 5A and B, No. 165. Extreme disto-occl., Cl. II, 1. Mouth-breather. Boy, who has probably suffered under sequelæ of vitaminosis and diagnostically of rachitis and habitus adenoidous, at the age of eleven and one-half and again at fifteen years.

Notice that the development of the wings of the nose and also the physical and psychical wings have increased immensely. This is on account of the changes in the whole pneumatic function and the blood circulation—especially in the brain—which occur after the alteration of the respiration from mouth to normal nasal-breathing has taken place.

Likewise the vitality, for instance, the immunity from infection and tooth decay, is increased considerably.

The cosmetical and æsthetical changes in the expression and the features of the face should be taken into consideration as an invaluable advantage for the individuals themselves.

Fig. 6, No. 565. Girl eleven and one-fourth years. Extreme disto-occl., Cl. II, 1. Abnormal lip function. Mouth-breather. Cast *à la* Van Loon.

Fig. 7, No. 639. Boy ten and three-fourths years. Disto-occl., Cl. II, 1. This cast is prepared by a simplification of Van Loon's method, the actual Körbitz's method, as shown in Fig. 9B, being used for the exact and easy orientation of the models.

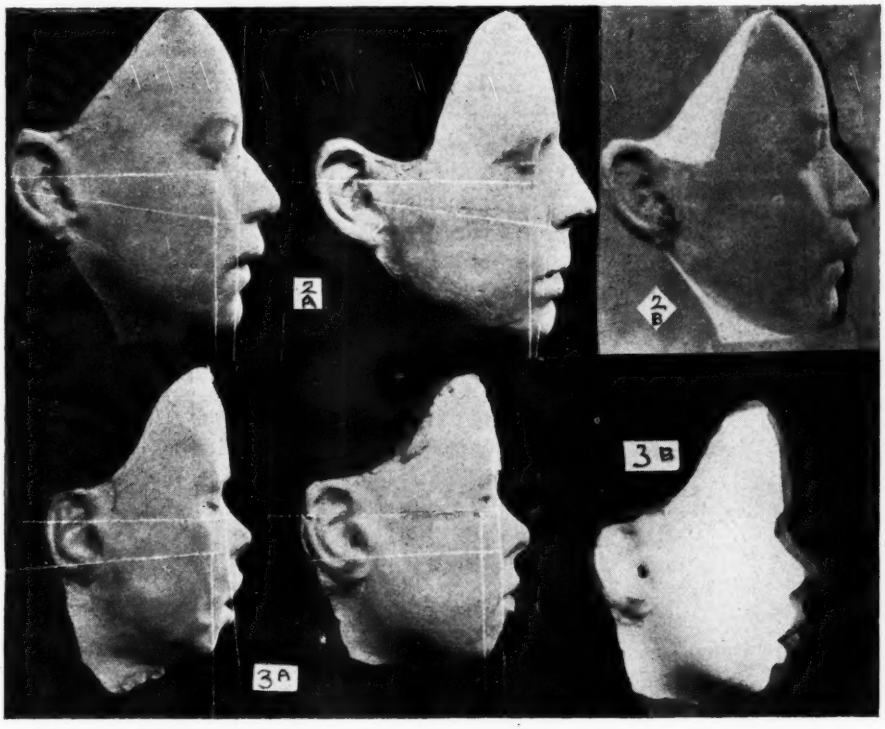


Fig. 8. Old method *à la* Körbitz. No. 536. Girl twelve years. Disto-occl., Cl. II, 1. Abnormal lip function. Notice also the malfunction of the incisors and comp. the differences between the two divisions of malfunction of Cl. II, Figs. 10A and B.

Fig. 9A, No. 21. Girl twenty-one and three-fourths years. Result of orthodontic treatment of disto-occl., Cl. II, 1, and mouth-breathing. Körbitz's method of orientation of the models and a "negative" profile cast. The method is shown in Fig. 9B.

Fig. 9B. Same as 9A. Körbitz's method. The models are removed in order to show that they are fixed in position by a little impression in "Stent's composition" by means of a metal wire melted in. When the profile cast is being produced, the impression is placed *in situ* with the wire passing angulus oris, so that it becomes enclosed in the cast. This method is also used in the production of Figs. 7 and 10.

Fig. 10A. Young man twenty-two years. Extreme disto-occl., Cl. II, 2.

Fig. 10B. Same as 10A. The models halved in order to enable one to see the relations of the palate and the malfunction of the incisors. Comp. with Fig. 8.

Fig. 11. After Viggo Andresen: "Die theoretische Grundlage des Andresenschen Präzisions Artikulators. Zahnärztl. Orthopädie u. Prothese," 1913.

The author's models plastered in tri-dimensionally in relation to the condyles, the median plane and Camper's plane in the anatomical articulator.

Disto-occl. and close bite. The occlusal plane converges backwards with Camper's plane.

Fig. 12. No. 571. Girl eight and one-half years. Disto-occl., Cl. II, 1. The models are formed by aid of Simon's "Gnatho-stat" and plastered in an articulator by means of a "face-bow." During the exposure of the face and the models a "photo-static" rod, with a kind of "cephalophore" gripping from behind and placed on the condyles, was, at the time of exposure, in the prolongation of the focal axis.

Fig. 13. The placing of the gnatho-phore into accurate position is naturally the base for procuring exact projections on the median plane. This placing can be controlled by the aid of a "face-bow" or with Martin's compasses, Fig. 11. The control must be undertaken with the gnatho-indicator *in situ* in the mouth. Here only the principle is outlined with the apparatus

in connection with the models. M—Martin's compasses; BI—Bucco-occlusal impression with G—the gnatho-indicator melted in; R—the ruler fixed in the median plane.

Figs. 14A and B, No. 649. Boy fourteen and one-half years. A, before treatment; B, the result of about half a year's treatment. Notice that Körbitz's frontal line, already after so short a time of treatment, has approached Simon's orbital plane at Gnathion, as shown on the former Figs. Notice the changed position of the front teeth in relation to Körbitz's frontal plane (directions of the bone trajectories).

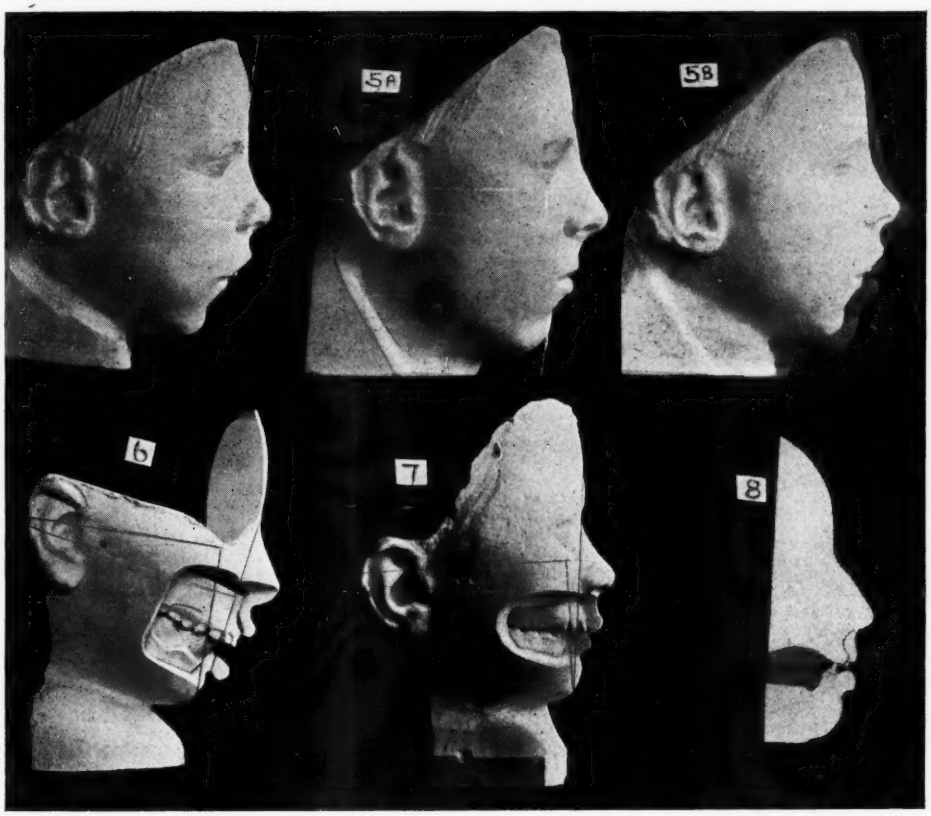


Fig. 15, No. 662. January 24th. Thirteen and one-half years. Neutral occl., Cl. I. Reduction especially of the apical frontal region. Lack of place for the wisdom teeth (?). Occlusal plane parallel with FH and KH. SO cuts the occusal plane in the region of the premolars. KF through Nasion and Alare runs behind Gnathion. Notice, on the longitudinal axes of the buccal teeth (parallel with the vertical lines) depend, in this case, good static conditions for the function. Comp. with Fig. 19.

Fig. 16, No. 639. (The drawing of the lines is not quite correct.) The same as Figs. 7 and 23. October 23rd. Ten and three-fourths years. Distal-occl., Cl. II, 1.

Fig. 17, No. 682. August 24th. Eight and one-half years. Distal-occl., Cl. II, 1.

Fig. 18, No. K2. 1922. Same as Figs. 10A and B. September 22nd, twenty-

two years. Distal-occl., Cl. II, 2. Occlusal plane converges backwards with FH, but is parallel with KH.

Fig. 19, No. 685. August 24th, thirteen and one-half years. Neutral occl., Cl. I. Reduction of the apical region. 2 + 2 in oral position. Regarding dentition the following is noticeable: 0, 3 persists (but is very loose) and + 3 has, as yet not quite erupted. All the other teeth, including 7 + 7 and 7 – 7, have erupted, 3 + 3 being the last of the twelve front teeth, which change, could indicate a regressive "atavistic" variation of retarded dentition (?). Comp. with Fig. 15 regarding the lines.

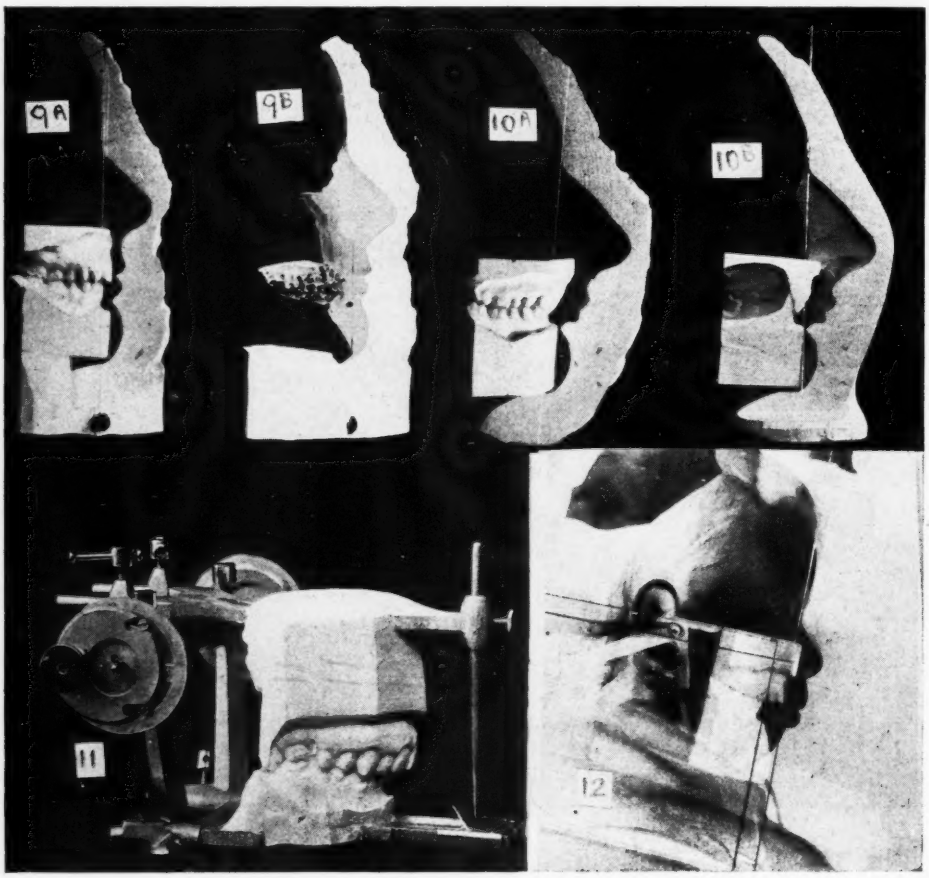
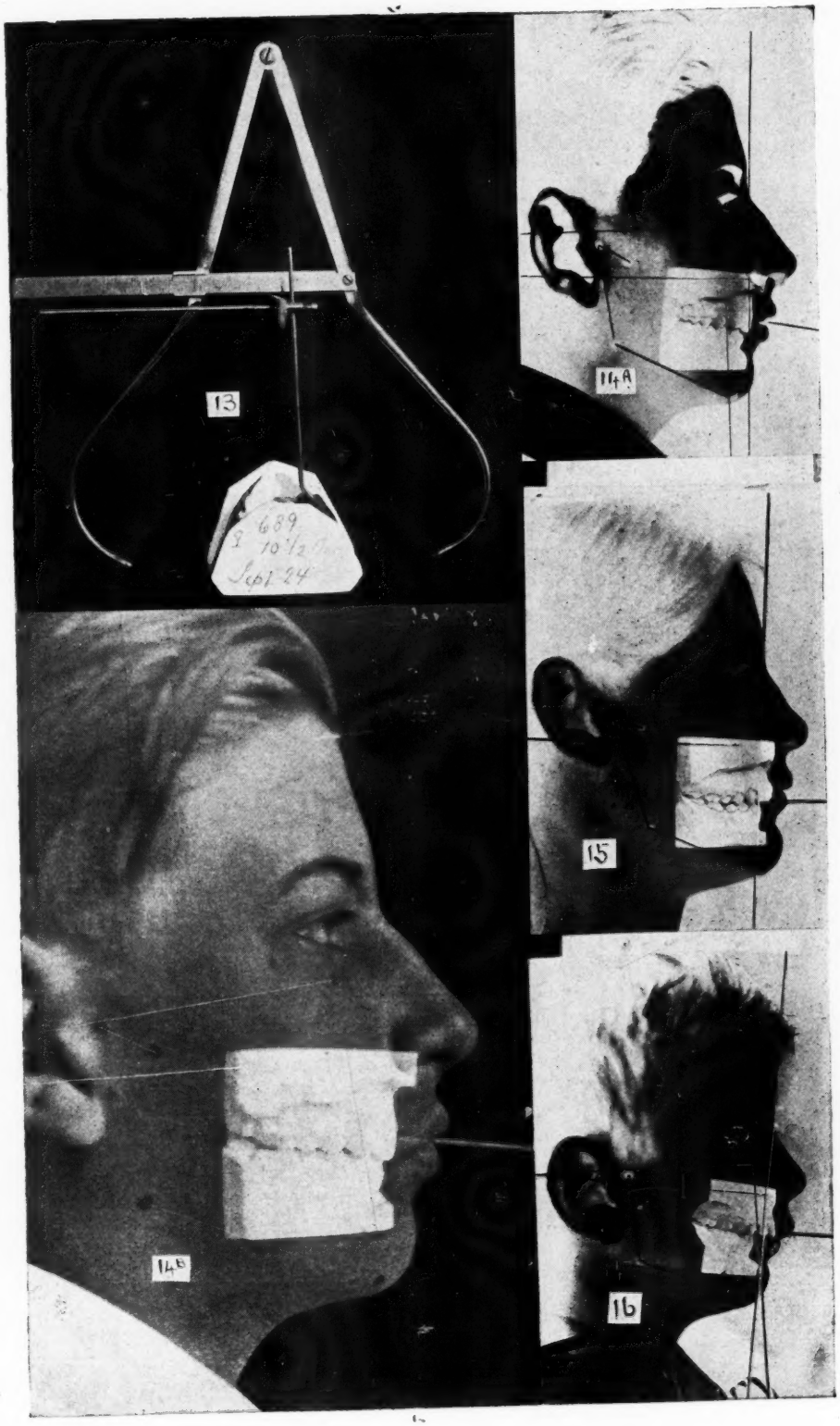


Fig. 20, No. 663. January 24th, ten years. Distal occl., Cl. II, 1.

Fig. 21, No. 681. January 24th, twelve years. Distal occl., Cl. II, 1. Regarding dentition, notice the following: all deciduous teeth in the lower jaw have changed, in the upper jaw 0, 5 – 0, 4 – 0, 3 + 0, 3 – 0, 4 – 0, 5 persist, 7 + and – 7 in eruption. Regressive "atavistic" variation of retarded eruption (?). Congenital micrognathia of the chin.

Fig. 22, No. 696. November 24th, thirteen and one-fourth years. Mesial occl., Cl. III, with open bite. Index 131. Normal dentition.

Fig. 23, No. 639. Same as Figs. 7 and 16. October 23rd (positive) and May 24th (negative). Ten and three-fourth and eleven and one-fourth years. Comparison of the temporary result of half-year's treatment.


13
14A
15
14B
16

Figs. 24A and B, No. 441. December 19th, sixteen and one-fourth years. Nearly neutral occl. with open bite. Persistency: 0, 5, 0, 3 + 0, 3 and – 0, 4. 0, 5. 0, 3 + 0, 3 have kept the place of 2 + 2.

Agenesis: 5. 4. 2 + 2. 4. 5. and 5 – 4.5.

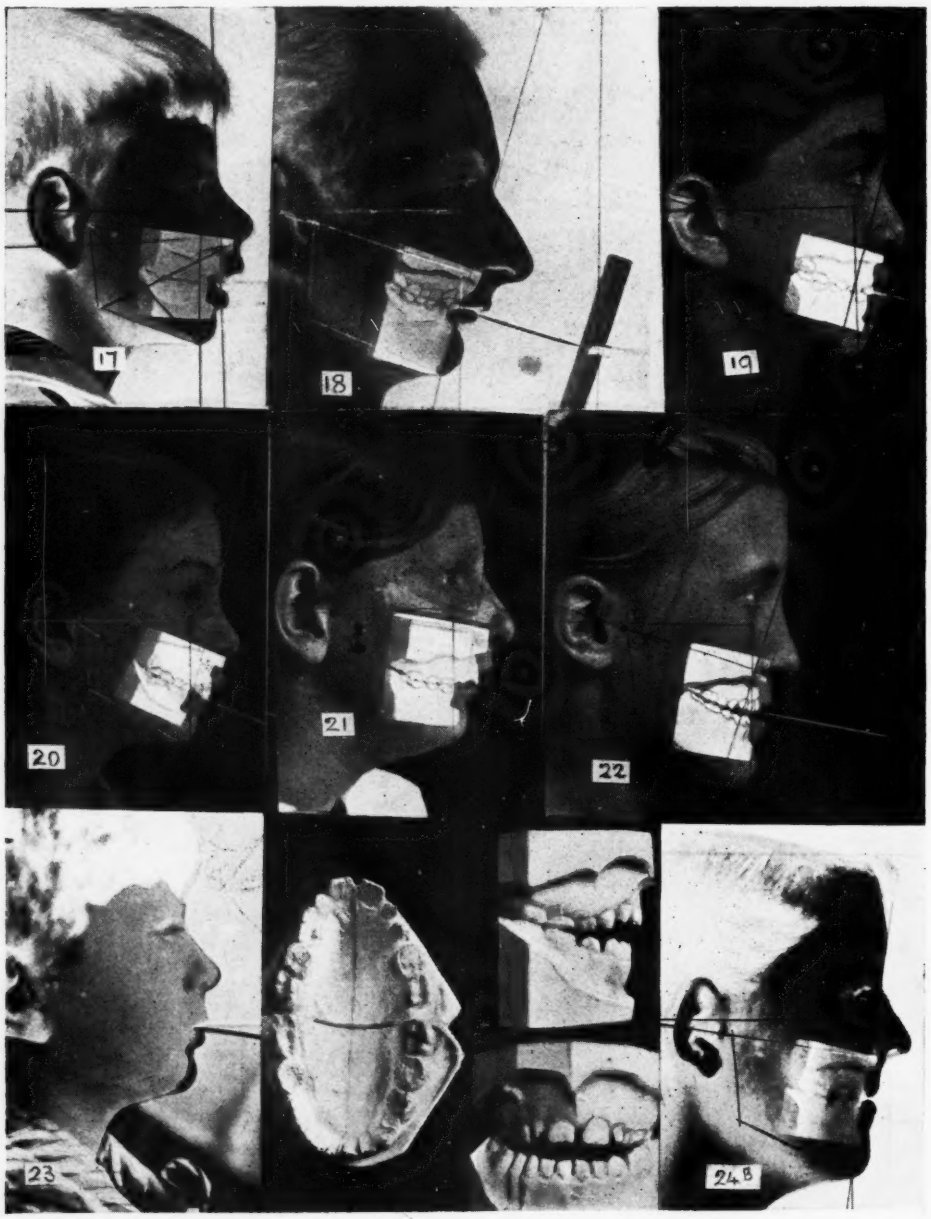


Fig. 24B, No. 441 (same as the former). September 24th, twenty-one and one-fourth years. Result of treatment: vertical lines meet at Gnathion; SOP cuts the region of 2 +.

Fig. 25, No. 488. December 24th, sixteen years. Result of treatment or distal occl. with upper frontal protrusion and close bite.

Persistency: 0, 5 + and 0, 5 –.

Agenesis: 5. 4 + 4. 5 and 5 –.


25
26
27
28
29A
29B
30
31
32
33

Fig. 26, No. 560. September 24th, twenty and three-fourths years. Nearly neutral occl. with 6 + in oral occl. Provisional result of treatment.

Extraction of 0, 5 – 0, 5. Agenesis: 5 – 5.

Fig. 27, No. 629. January 25th, sixteen years. Distal occl. with upper frontal protrusion and close bite. Result of treatment. Notice especially the vertical lines.

Agenesis: 5 + 5 and 5 –.

Fig. 28, No. 657. January 25th, thirteen and one-half years. Nearly neutral occl. with lack of place for 3 +. Treated by extraction of 4 +.

Agenesis: 2 –.

Figs. 29A and B, No. 661. February 24th, thirteen and one-sixth years. Extreme distal occl. with upper total protrusion. (Treated by extraction of 6 + 6.)

Agenesis: 5 – 5.

Fig. 30, No. 667. January 24th, thirteen years. Unilateral mesial occl. with retension of 3 +.

Agenesis: – 5.

Fig. 31, No. 675. May 24th, thirteen and one-fourth years. Neutral occl.

Agenesis: 5 – 5. Comp. both summaries.

Fig. 32, No. 695. October 24th, thirty-six and one-half years. Distal occl. on right molars. Frontal reduction of the size of the jaws.

Agenesis: 2 + 2 and supposedly – 2.

Fig. 33, No. 669. December 24th, eight and three-fourth years. Distal occl. of frontal teeth.

Agenesis: 5 – 5.

"(2) In the upper class European races with a greater brain, the reduction of the lateral upper incisors and the wisdom teeth is more marked than in the lower non-European races.

"(3) In the northern long-headed people the lateral upper incisors are more frequently reduced, the wisdom teeth more rarely, than in the short-headed Alpine races. This particular phenomenon is most probably based on formative mechanical causes. In the former the tooth arch is less developed in the anterior part, in the latter less wide in the posterior part.

"(4) In females the reduction of the lateral upper incisors is further advanced than in males."

Roese[7] must, unfortunately, not have been acquainted with the reduction of the second premolars, as he has not paid any attention to, or made mention of, these teeth.

Dr. Charles R. Baker[8] has also made a report, of which the interesting statistic on page 249 may be cited.

"I wish to report a series of 262 cases in which radiograms covered every region of the mouth anterior to the permanent second molar, in which the permanent teeth had not erupted. . . . No record was made of third molars."

This report, which the author has recently come across, makes no mention of the typical reduction, but the numerals are very interesting, they being in accordance with those of the author.

According to the author's experience and minimal statistics, it seems, how-

Teeth congenitally missing

Upper	*Left*	*Right*
Lateral incisor	7	10
First premolar	2	2
Second premolar	11	11
Second molar	1	1
Lower		
Central incisor	2	1
Lateral incisor	1	1
Second premolar	22	23
Second molar	1	1

ever, to be these teeth which, after the wisdom teeth—these being naturally excluded in the case of children—most frequently show signs of progressive reduction. Twelve cases show this, while in comparison only seven cases show lack of one or more of the lateral incisors; two cases are mixed, and one or two cases lack the central incisors in the lower jaw. The author then gives a summary of twenty-four cases of progressive variation of the human set of teeth.

The "future set of teeth" is most frequently characterised (1) by the qualitative and quantitative reduction of the wisdom teeth; (2) by agenesis concerning the upper lateral incisor and especially the lower posterior premolar, and (3) by persistency of the lower second deciduous molar. The biological reduction of the human masticating apparatus is frequently signified by different prodromal signs. Of these symptoms the histological and morphological malformation and rudimentary development of those teeth, which are designated by nature as superfluous, are perhaps the first reminders; the second are the frequent appearance of crowded teeth, especially on account of the under-development of the intermaxillary bones[9] and of the "apical basis."[10]

The only words in relation to therapy and prognosis is a conclusion by Eckermann,[9] who says: "As to the orthodontic consequence, which ought to have a special chapter for itself, it follows that in the earlier stages of displacement of the cuspids, or generally speaking in cases where there is no complete retention, it is quite correct to extract the lateral incisor at the expense of the traditional cosmetical consideration." The intention of this paper is to point out that orthodontology must take the racial view regarding the biological reduction into consideration in a higher degree than before.

SUPPLEMENTS AND CONCLUSIONS

(1) Presupposing that the labyrinths, on account of their function to keep the head in equilibrium, practically speaking, do not change their relative position during the growth of the head, the author proposes to use the axis through these organs as a convenient point of orientation by placing the photographic plates together and thus establish a fixed starting basis for demonstrating and studying gnatho-physiognomical changes by growth or orthodontic treatment.

(2) The production of photographs with the teeth placed in exact profile projection of the face may be advised as a very important aid. The necessary corresponding exposures of the face in profile and of the models are procured

by means of a special gnatho-physiognomical indicator, which, visible on both plates, indicates the right relations in placing the plates together.

(3) Whilst most of the malocclusions are the result of errors in malnutrition and malfunction, many cases are however caused by the progressive reduction of the human set of teeth (combined with progressive increase of the brain).

Two questions arise in cases connected with phylogenetic, progressive reduction, the—so to speak—malpractice of nature in our professional realms: (1) How are we to classify them, and (2) how are we to treat them? *Re* No. (1). As we find cases belonging to the different classes of Angle's system combined with and complicated by reduction as an etiological factor, there are some reasons for placing these malocclusions in new classes or subdivisions, and for revising or renewing the old system by some additions.

As a matter of fact too little notice of etiology and prognosis has hitherto been taken. This is especially the case when the etiology depends upon regressive variation, e.g., of the number and size of the teeth or of the second dentition. The author intends in a later article to treat especially the latter factor, viz., the eruption of the cuspids in humans as in apes, after the other deciduous teeth have changed and the second molars have likewise erupted. As is well known, the lack of place for the cuspids and bi-maxillary protrusion (Fig. No. 19) arises in this way and occasions many problems.

The second question can perhaps better be formed as follows: Are there any indications to imitate the so-called "Zukunftsgebiss" by artificially completing asymmetrical cases of reduction, viz., by extraction, especially of the upper lateral incisors and the lower second premolars which may be formed?

The answer must be: If the terminal reduction (Bolk) of the set of human teeth is in accordance with phylogenetical laws, it must also be so in relation to orthodontological laws. It must however be mentioned that the liability of the persistency of the second deciduous molars and their probable future transformation into a permanent molar, as a part of Bolk's theory, must be taken into consideration. It must further be mentioned, that the question regarding extraction of the upper lateral incisors is also a question which has relation to the present and not alone to the cosmetic ideal of beauty. In cases of asymmetrical treatment, e.g., if only one of the upper incisors or lower second premolars are missing, it may be necessary to retain or even increase the space for the missing teeth, instead of extracting on the opposite side of the jaws. We are, however, in want of systematic rules for the judgment of indications and contraindications concerning extraction of certain teeth. Regarding this point the author has tried to find a gnatho-physiognomical index, but although he has procured some very interesting results, he has come to the following conclusion: It will be necessary to elect a committee, who will devise rules for systematic investigations regarding the diagnosis, therapy and prognosis concerning cases of incomplete and asymmetrical treatment. A co-operation of all orthodontologists is necessary, cases where the artificial (eventually modified) reduction is necessary, being not very rare.

According, however, to the rarity of "the normal Zukunftsgebiss," the anthropologists have not yet designated this future human race by a special

adjective, e.g., *Homo supersapiens* s. *subdentatus* Bolk. Orthodontology owes a great debt to Prof. Bolk, of Amsterdam, who has created a unique collection of skulls, whereon his thesis of the progressive terminal reduction is based. Orthodontology has, however, the duty of furthering and utilising this important science.

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[9]Eckermann: Das Eckzahnproblem. Deutsche Monatss. f. Zahnheilk. December, 1908.
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[11]Martin: Anthropologie, 1914.

DISCUSSION

The President said he was very sorry that Dr. Andresen's paper happened to be the last on the programme, because he saw there were a great many empty seats. Many of those who had been present the previous day had had to depart, and they had missed a very good thing. Those who had stayed had been very well repaid for doing so. He thanked Dr. Andresen very much on behalf of the Society for bringing before it his work, and he desired to apologise for the very short time that had been given to Dr. Andresen for the delivery of his paper.

Dr. Lind said that he, more than anybody else in the Society, appreciated the fact that his dear old friend and teacher, Dr. Andresen, had attended to read a paper before the Society. He had known Dr. Andresen for as long as he had been practising dentistry, and knew how industrious and genial he was, and the tremendous amount of work he did, and how when he got his own ideas he followed them up. The present paper was a slight example of Dr. Andresen's ability. He was sure that when the members studied it in the *Proceedings* they would gain some very good ideas and useful information out of it which they would be able to use in their future diagnoses. There was one point which he thought was very important, and that was the reduction of the denture, on which so many opinions were expressed. It was too late to go into the subject at that moment, but a few days ago Prof. Bolk had sent him his latest paper which had been read before the Royal Academy of Science, and which contained some very remarkable statements about the subject. Prof. Bolk had investigated the question of the terminal reduction of the denture very carefully and thoroughly. Prof. Bolk had an enormous amount of material from which to investigate the matter; he had a collection which was unique in the whole world. Prof. Bolk was the man in the whole world who knew most about it. Orthodontists should not neglect this factor, but study it very carefully, because they would be able to find in it something which they all needed for their diagnoses and treatment.

The President said what Dr. Lind had just said opened the way for him to remind the members that Prof. Bolk's museum was worthy of two or three visits rather than one. The Society would think over Dr. Andresen's suggestion of the appointment of a small Committee to draw up systematic rules for the investigation of the subject, and bring the matter forward at the next meeting. He could only repeat again what a pleasure it had been to all of them to hear Dr. Andresen, and to thank him most heartily for having attended to read the paper.

The meeting then concluded.

A DISCUSSION ON SOME OF THE PROBLEMS IN THE TREATMENT AND RETENTION OF CASES OF IRREGULARITIES OF THE TEETH IN EUROPEAN COUNTRIES*

By A. C. Lockett, L.D.S., D.D.S., of London

I THOUGHT it would be rather an innovation, and departing a little from the general custom, if we had what I should like this to be—a sort of heart to heart chat between ourselves rather than something in the nature of a paper. I think we are very fortunate in many ways in our Society, inasmuch as we have so many representatives of different nationalities in it, who can express their views on any particular matter based more or less on the difficulties and problems which they are up against in their own countries. I wish just to mention a few of those in connection with the conditions in England. I am particularly anxious that our friends from America should get some idea of a few of the actual problems which we have to face from day to day. We have gone into this matter in the past from a purely scientific point of view, and we are all pretty well satisfied that we are groping in the dark on many points which we should like to have elucidated and cleared up; but we have never looked at this matter from a purely domestic point of view, and I think this is a good opportunity to do so. My remarks will be based almost entirely on the practical side of our work, and the difficulties in connection with it.

First we have the lack of cooperation on the part of parents. That, of course, is common in all countries, but it is very marked in England. We have not educated up our people. I do not mean the masses as a whole; I will not go as far down in the scale as that, because it would be a question that would have to be approached from an entirely different point altogether and in a different way. The parents as a rule do not realize the importance of having the work done, and of having it done in the way in which we would like to have it done. They are not prepared to give up as much time to the consideration of the subject of the child's welfare as perhaps parents of other nationalities. There are so many things they have to consider. There is the question of the part which education plays. I will not go very much into that now, because that comes under a separate heading. There is also a still greater lack of cooperation on the part of principals of schools, particularly the masters of public boys' and girls' schools. The school question is a difficult one in England. I do not think the actual school life in England is the same as anywhere else in the British Empire; certainly it is quite different from school life on the Continent and in America. We have little private preparatory schools, it is true, and the boys probably may be day pupils in those establishments; but we have also a lot of preparatory schools where the boys are sent off at the age of eight or nine. The

*Proceedings of the European Orthodontological Society, 1924.

life in those schools is to all intents and purposes just a preliminary stage of a large public school. The girls' schools are very much on the same lines—perhaps more so now than they used to be. There is one thing which I think we are up against in England in a very much greater way than you are up against it either on the Continent or in America. I do not want you to think that our boys and girls are the only boys and girls who play games; but this I do know —that there is no country represented here in which the question of games stands more at the head of the day's curriculum than it does in England.

Before the war we always had difficulties in getting boys and girls from school when suffering from colds or influenza or measles, and various other ailments which are common to children. There were no facilities given by principals of, and the physicians connected with, schools with regard to infection. Since the war that has altered. In their own interests, as far as protecting the well-being of the school is concerned, they now say: "We will not allow these children to leave our schools to go anywhere unless the parents come there and take them in their motor-car to the place where you operate and work, and take them straight back. They must not get into a train or a tramcar." They will not run the risk of bringing infection after they once get them into the school. They take very strong precautions to be certain that no infection is brought into the school when the children come in from their holidays. I do not know what you do on the Continent in that respect, but that is becoming a very strong factor in England.

Assuming the fact that you succeed in getting a certain number of these children to come to you by any means whatever, either through the method by which I have suggested—that is private cars bringing them straight from the schools to your place—they all want to come on Wednesday afternoons between half-past two and four o'clock, or on Saturday mornings.

Then there is the question of holidays. Summer holidays begin at the end of July and end in September. Then there is Christmas and Easter. You can bet your last shilling that more than half the children you are treating are down with influenza or colds during the Christmas and Easter terms, and that as soon as the summer holidays come along they want to go away to the seaside or to Scotland, and they all come in the same day by the same train; and if you are in general practice the parents want something done at the same time. I only mention these things to give you some idea of what chance a man has of fitting in a nice, beautiful appliance. You see a boy with an irregularity, and you say, "I will take him in hand during his holiday." He will come by appointment, but you have so many of these other children coming at the same time, and you cannot turn them away, because it is the only opportunity you have.

With reference to the amount of time which parents are prepared to allot for treatment and retention, you are hardly ever allowed to exceed three years, and you are lucky if you get that.

Then to my mind comes the most serious point in the question, namely, the English type of face and denture as compared with other types of faces and dentures, and the effect of public opinion on your work. By public opinion I mean not only the parents themselves but the patient's relatives—their aunts

and grandmothers and fathers and intimate friends. Although you may do the work perfectly, the parents are not satisfied. You can convince them that it is right, and they will admit it, but they will say, "There is something about it that does not look right. Mrs. Brown does not like it, and I do not like it." You say: "It will be all right later. The face will fit in." Then the third molars come down, and they come back and say: "There is too much teeth here. This girl is ruined." It is simply because public opinion in England is not accustomed, for instance, to the wide arches which you see on the Continent. The dentures are quite different. They have some Anglo-Saxon types in America, and that is where they get their failures. One of the first things which Dr. Oliver noticed when he first came over to England was not so much the bad teeth as the fact that there were so few teeth present. English people do not show their teeth. If you make them show a lot, public opinion sooner or later will be against you. I have seen cases of beautiful work done abroad—perfect work. Then the people have come to live in England, and sooner or later they begin to get unhappy about things. They come and say: "There is something wrong about my daughter's mouth. She does not look as English girls do and I want her to." What are you going to do about it? You cannot interfere with the work. It has been done perfectly, but public opinion is against it. That is the most serious thing we are up against.

I would like to know from our friends here today their opinion as to when a case of irregularity is really finished and off one's hands, and about what is the general average amount of time which has been devoted to it over a number of years. Where are we, really, on this subject of the treatment of cases of irregularity? It is about twenty-five years since the subject became more or less a specialty in some parts of the world, and I really do not feel that we are any nearer a true solution of this problem than we were then. A great deal of progress has been made on the mechanical side of it, and on the study of the scientific side of it. I do not wish to belittle anybody's efforts, but the whole point is what has been actually done, and where are we? Are we going to establish a foundation with the aid of different appliances? Are they going to do any more for us than what has been done in the past? Can our friends in America do anything? If I was in America I would probably treat exactly on the lines they do, but I am not so sure that they do not have a great many more failures there than we have over here. The most encouraging thing about it to me is that men do not now seem ashamed or afraid to say that failures have taken place. It takes a good deal of courage for men to talk in that way, but that is the sort of thing we want.

There are other points which I might mention, but those are the main ones which I wish to bring out from my own experience in England. I would like to hear what you other gentlemen have to say about it. I am more happy about the future of my work than I was, because I have been trying a few experiments on absolutely different lines. I am going to bring out a record of it more or less in its crude form. I shall probably be laughed at but I do not care; if I get where I want to with as few appliances as possible and in as little time as possible, and as long as I can satisfy my people within a year or two, or at the outside three years, and keep them happy and contented, that is all I want.

They will give me more recommendations than I have ever got out of the old general principles, which have been adopted and tried. I am much happier over it, and I am certain the work is better.

The President said that Dr. Lockett had given a real heart to heart talk. That was the kind of thing which the members needed—an opportunity to bring up all their troubles and to ask each other what they thought of them, and to get assistance and advice. Dr. Lockett had brought up his troubles, and no doubt other members would bring up theirs.

Dr. Hipwell remarked that Dr. Lockett's address was one of the best things the members had ever had. They had had scientific addresses, religious addresses and so forth, but occasionally they did need such a heart to heart talk as Dr. Lockett had just given.

Dr. Lockett had spoken about the "rush" on Wednesdays and Saturdays in England. In Paris he had it on Thursdays and Sundays. The rush was so great on Sundays that he had not been able to attend church for more than ten years past!

With reference to Dr. Lockett's description of the complaints of relatives about their children being all teeth after treatment, the same thing occurred in France. The child was undeveloped, the chin was undeveloped. The nose had never been developed; it had been working abnormally for several years, and then when the teeth were got into normal occlusion the child looked all teeth. Then the mother came along and said: "My daughter is all teeth." The reply one made was: "Just wait for about three years until the child begins to use its nose as it should have been used, and develops these muscles, and then your child will look like Mona Lisa."

He had never appreciated the statement at the time it was made, but a man who had a great knowledge of orthodontia and who had been a member of the Society, namely, Dr. Kirk Davenport, had once remarked that it was a very difficult thing to do orthodontia in Great Britain. He had not realized what Dr. Davenport had meant, but Dr. Lockett had now made it clear.

One point to consider was whether the operation had been paid for. If it had been paid for, it was generally found that the patient did not return.

It had been a great treat for him to have been present with his brother orthodontists, to get their ideas, and to help all he possibly could in return. He had learned enough from the present meeting to keep him occupied during all the winter. He always read four nights a week.

In conclusion he would lay stress on the fact that there were enough cases in every city from which orthodontists were able to get good results. Orthodontists could afford to choose their cases, and when they did so they got results which pleased themselves and pleased the patients. If they were not particular in choosing their cases they would only get into trouble and would not get the results expected.

Dr. Coebergh agreed with Dr. Lockett that the English type of face was a difficulty. What Dr. Lockett had stated about the patient's relatives not being content with the result of the operation applied in just the same way on the Continent. The relatives said: "Now the son's face does not correspond with the

face of his grandfather, and so no longer is he a member of the family." He quite agreed with Dr. Hipwell that orthodontists should choose their cases.

Dr. Oliver said that what had struck him more forcibly than anything else during his sojourn in London had been the number of artificial plates in use, especially on the stage. He had seen a young lady in one of the best shows in London with an entirely artificial set of teeth. It was a proposition which he did not understand, but with arches which were deformed, he might call it, how was one going to replace those artificial dentures satisfactorily? In America probably things were different. Practitioners in America had a definite understanding with their patients before they started. They promised the patients nothing; they went over the case with them, showed them the models and gave them to understand as nearly as possible an outline of what was intended to be done, and then the patient was told, "I will do the best I can." The question of finance was also gone into and a thorough understanding come to before the operation was started as to how much the case was going to cost and as to how it was going to be paid. The patients almost immediately asked: "How long will it take?" The reply was, "I do not know; two, three or four years—sometimes less and sometimes more." After all that had been gone into then the patients said whether they wanted to have the treatment or not. Some orthodontists charged in thirds, some in fourths, some so much a year, and some so much a month with the initial payment.

He believed that if children were placed under efficient dental observation till the age of 12 years, a great deal of extractions and bridge work and plate work would not be necessary later on in life. But that meant educating the people. There was also education needed amongst the ranks of the dental profession. The medical profession in America were forcing the dental profession there to do more educational work, and were cooperating. Twenty-five per cent of his own patients were referred to him by medical men.

With regard to the position in Europe, there, too, it was a matter of education. People had to be educated in order to appreciate the fact that the mouth was the gateway to all infections, and that the mouth in normal occlusion, with good teeth, meant good health, and that a protruding face was as nothing compared with good health. He did not know what advice he could give to his European confrères. Whether or not English orthodontists could impress upon their patients the importance of the subject by showing them photographs or models he could not say. It seemed to him that a city like London with over seven millions of inhabitants ought to be able to support quite a number of orthodontists working hard all the time. The city of Detroit, with a population of one million, had eighteen men specialising in orthodontia, and all of them were doing well and had enormous practices. Whereas a few years ago in the southern and southwestern portions of the United States there were only a half dozen orthodontists, today the Southern Society had some thirty-one or thirty-two men, and the Southwestern Society had some twenty-seven or twenty-eight, and there was still plenty of room yet for many more good men. But they were not wanted unless they were good men; bad men did not do any good to anybody. He knew, from walking the streets of London, that there was enough work to be done in London to employ all the orthodon-

tists in America there. He would venture to say that all the dentists in America could not take care properly of the mouths of the children of one large state. The dental profession had got to begin practising preventive work and not so much curing. There were lots of cases in orthodontia which simply needed some little proposition corrected, and then nature should be given a chance. Nature was wonderful, and she would do the rest. The appliances which were in vogue today, and which did not need adjusting more than once in three or four months, ought to help in the situation a great deal.

He desired to take the present opportunity of expressing to the Society his appreciation and thanks for the opportunity he had had of appearing before it. He had been treated very kindly. The European Orthodontological Society certainly had a fine bunch of men in it. He could say with all seriousness that he had never appeared before any Society in which the members gave more serious thought to their work than did the members of the European Orthodontological Society. He hoped some day that American orthodontists would have the opportunity of entertaining them in America, and, if that did happen, his own door would be open to any of those present at any time, and as long as ever they liked to stay with him it would not cost them one penny. He sincerely trusted that the members would take the opportunity of going to America in 1926, because he believed that the meeting which was then going to be held there would be the greatest that had ever been held in the history of orthodontia.

The President thought that Dr. Oliver had just given as nice a heart to heart talk as anybody could have wished to hear. He desired particularly to thank Dr. Oliver publicly for his cordial invitation, which he had extended to all the members present to visit him and to learn from him all that he had to teach—which meant a great deal. The best man among them had a whole lot to learn from Dr. Oliver.

Dr. Barrows said it seemed to him that if Dr. Lockett would utilise some of the present removable or fixed appliances he need not see his patients quite so often, and then perhaps his Wednesday afternoons and Saturday mornings would not be quite so fully occupied. If one saw the patient at the end of a term, at the beginning of a term, and perhaps once in the middle of a term, one could accomplish quite a lot.

With regard to the question of dissatisfaction, he thought that if the patient paid for a thing it made quite a lot of difference. Personally he always tried to get a third paid at the beginning.

He quite agreed with Dr. Lockett that it was difficult to satisfy people. Children's faces did develop and did change very much. A child of ten very often did look as though it were all teeth, but in most of those cases he thought that the parents and relatives agreed that the practitioner had done the best he could if he put the teeth into fair alignment.

Dr. Oliver said it was true that at about the age of twelve years all children to a certain extent looked as if they were all mouth. That was about the time the orthodontist finished with them, and they should explain to the parents that it was a matter of nature. If one exhibited photographs depicting the appearance a few years after, a great deal of difficulty was overcome.

Dr. Henry said he agreed that the English type was a pronounced type, whereas Americans were a conglomeration of races. He could quite see the point that the English expected to look all alike. He had always remembered a saying of Dr. Jackson's, one of the fathers of orthodontia, that an orthodontist had always to remember that there was a man's teeth or a woman's teeth in a child's head.

Dr. Busby remarked that the people of America were more impressionable than the peoples of Europe. The American race was a new people. In America there was a saying: "We will try anything once." In the days of his grandmother small feet were very much appreciated; to have large feet was considered common and vulgar. Also a large mouth showing all the teeth was at that time considered common and vulgar. But nothing was considered more beautiful now in America than a pretty girl with a mouth which showed all her teeth.

He might conclude in a jocular vein by saying that he had said to a friend of his living in one of the Central-Western States: "Doctor, do you ever finish with any of your orthodontic cases?" His friend had replied: "Yes. A few die and some move away."

Mr. Harold Chapman said it seemed to him that Dr. Lockett had divided the difficulties into three categories—the parents, the schools and the type of beauty. Personally he was inclined to think that perhaps the latter was one of the most important. It was certainly a very important one, and he would endeavour to give one or two instances.

Some time ago a lady had brought two of her daughters to see him. One was seventeen and the other fifteen. They both had what might be called superior protrusions. One of them was extremely bad, and the other was quite bad. In his opinion both those children needed orthodontic treatment extremely badly, but the mother told him that she thought one wanted treatment and that the other was all right. That had taught him a great lesson; he thought one child needed treatment badly, but the mother thought there was nothing the matter and did not want anything done. Since that time he had been extremely careful to endeavour to find out from the parents what they thought was wrong with the child. He did that as one of the first things—he would not say in every case, because in children of about six it was not so important, but in elder children it was of great moment.

To give another example, a lady had brought a child to him the other day, a girl about thirteen, in consultation. She had been under treatment for three years—two years by one dentist, and had had previous treatment by another dentist. How long that had been going on he could not say. Three teeth had been taken out—two first upper premolars and a lower incisor. He had not seen the very original models, but there was still a considerable advancement of the upper incisors before the lower incisors, and the molar series on one side in the upper was lingual to the other. The dentist who had written to him thought it would be good treatment to remove three more teeth—the first two molars on the right side and the lower bicuspid on the left side. So that the child would have then had six teeth out. Then he had proceeded to find out from the mother what she thought was wrong with the child. He had given the members

his impression of what was wrong—that the upper incisors were in front of the lower. He could not get anything out of the mother. In the end all he could get from her was that she thought the centre lines were not correct. The centre line had moved over to the side where the bicuspid had been removed, and so on. He had replied to the mother: "If that is all you think is the matter I should certainly leave that alone, because I do not suppose there is one person in a hundred who will see that that is wrong." That was a problem which it seemed to him orthodontists had to consider very seriously.

He might quote another example of the same kind. A lady had brought a young patient, about eight or nine, Class I. The mother of the child had a very keen eye for beauty, and was a very shrewd judge. She had been brought up in Paris. The mother had an objection to having the child being all "toothy" when the treatment was finished, so it seemed to him that the only thing to do would be ultimately to remove four premolars. Some of the temporary canines and the first deciduous molars were there. However, what were not there were removed so that the incisors could be straightened. In about three months the mother decided that the child was going to look too underdeveloped in that region, and had changed her mind, and now the child was not going to have her bicuspids removed. There were problems from that point of view. One had to treat each case on its merits, and the idiosyncrasies of the parents had to be considered. From the three cases he had mentioned the members could see that it was really a matter of idiosyncrasy and that the practitioner was not able to decide for the patient. Dr. Lockett had mentioned about the parents coming back and grumbling.

Dr. Lockett said it was not so much the poor unfortunate mother as English public opinion.

Mr. Chapman said that Dr. Lockett had certainly not exaggerated in that respect, but personally he thought it was not quite such a hopeless position as Dr. Lockett had made out.

Dr. Lockett said he was sorry if he had given that impression.

Mr. Chapman said with such appliances as Dr. Oliver had shown, one could send away children for a whole term, and they would come back with their apparatus on all right. He did not say everyone would be all right as there were bound to be accidents, but quite a good proportion came back without any trouble. For the first year he tried to get the children to return in the middle of the term, but very frequently they did not and everything kept all right. He thought, therefore, there was great hope in that direction. He also agreed that it was the best thing not to interfere with the apparatus—or at least to interfere with it as little as possible. There was a tendency for one to have an itching to look at it and to interfere with it, but it was certainly best not to do so.

There was another point, too, which was going to help very considerably if they could educate the dental profession to realise that caries of the deciduous teeth and loss of the deciduous teeth made a heap of work for the orthodontist —work which never need exist. He could prove that if there was time to show some slides which he had brought with him.

There was one question he wanted to ask of Dr. Oliver on the matter of retention. Dr. Lockett had spoken about the long time that retention was required, and Dr. Oliver had referred to the short time. There seemed to be a discrepancy there, but he was quite sure the discrepancy was not what it appeared to be. Perhaps Dr. Oliver could tell them how to correlate those two things—whether he carried on his treatment longer instead of doing what used to be called "retention" or how it was. He thought Dr. Lockett had done a great service by bringing up this matter.

Dr. Lockett, in reply, said he hoped he had not given the impression that he considered the whole question hopeless as far as England was concerned. All he had wanted to do was to give his American confrères some idea of some of the problems which English orthodontists were up against, with the idea of soliciting their sympathetic consideration. English orthodontists intended to solve the problem somehow or another, and they were anxious to get help, and were quite willing to receive it, from whatever source it came. The matter had to be solved in some way or another. It had given him a good deal of interest in life to have something of that description to fight against from one year's end to the other. That was why he was particularly anxious that the matter should be kept in mind. There had been lots of points which he had desired to go into, but he had refrained from doing so owing to the shortness of time at his disposal. He wanted his American friends to remember that the present meeting had been to a very large extent made what it was by the work that they had done and what they had shown. He wanted Dr. Busby, Dr. Oliver and Dr. Fisher to carry away the impression, which he thought was already riveted on their minds, that the members of the Society were a great body of thinkers. Personally, he did not think that in any other Society or in any other branch of dentistry throughout Europe did the members more seriously work than did those of the European Orthodontological Society. The doors of the Society were always open to as many orthodontists as cared to come.

THE CROZAT REMOVABLE APPLIANCE AND SOME OF ITS ADVANTAGES*

By O. J. Henry, L.D.S.Eng.

YOU are all familiar with the excellent principles embodied in the Jackson removable appliances.

(1) Your force is reciprocal.

(2) Your anchorage is stationary; through the cribbing device you get bodily movement of the teeth.

(3) You retain the approximal contact of the teeth by moving them *en masse.*

(4) You have the aid of the forces of occlusion.

Now we are indebted to Dr. Crozat for developing a technique whereby we can employ these principles in a removable appliance, taking advantage of the spring force of the modern elastic gold and platinum wire in making the appliance and utilizing the auxiliary spring attachments of the Mershon technique. This appliance is composed of a body wire, S. S. White clasp wire, 15 or 16 gauge. Two arms, 18 gauge, S. S. White clasp wire, to which are attached the cribbing devices, Ney's 21 gauge, which holds it firmly in place. Finger springs, S. S. White 20-21-22 gauge clasp wire attached to the arms or body wire. The body wire gives stability and allows expansion in the molar region. The arms allow expansion from the mesial cusp of the first molar forward.

The cribbing devices, through their construction encircling the teeth and following closely the line of the gums on the buccal and lingual, hold the teeth as stable as possible, allowing very little tipping, and we get bodily movement of the teeth in expansion. I will pass around a typical case of neutro-occlusion; photographs 1 and 2 are sketches of the same. Here the teeth in the three segments of the arch are in their normal relation to each other, and we want group movement of the teeth in order to retain the proximal continuity.

For anterior expansion of the arch the posterior loop of the body wire is used as rotary centre, and you can see you will get a uniform diffused expansion, with the greatest expansion in the premolar region as desired in most cases. Should you want positive molar expansion your rotary centre is the middle of the body wire, and you bend it open there.

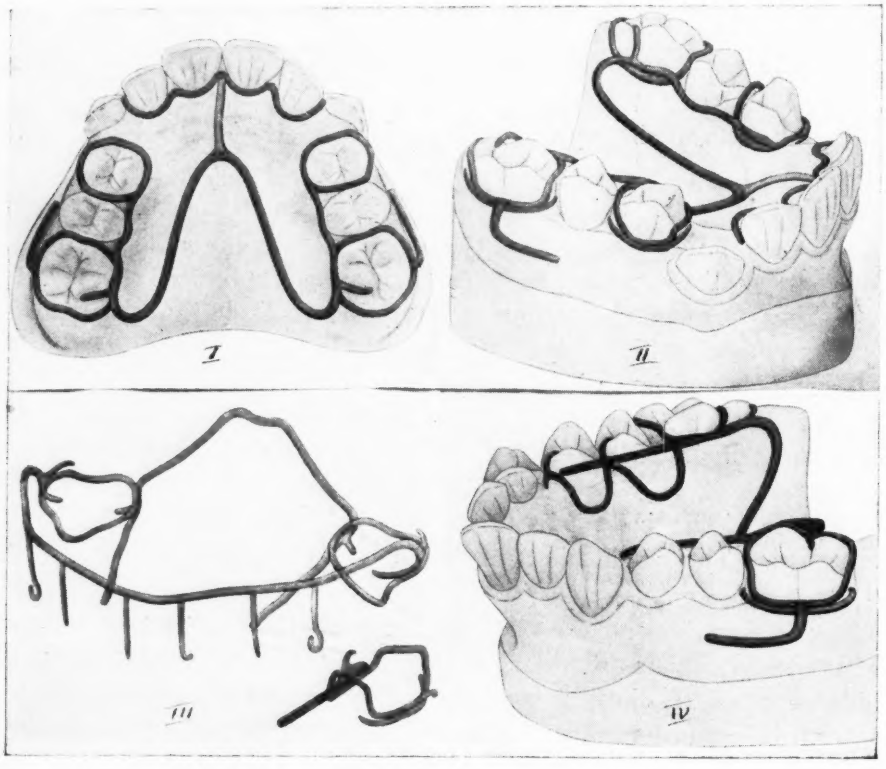
For the anterior segment is used a T-bar finger spring of 19 gauge platinum iridium from the body wire, which is made active by pinching the wire with the wire-stretching pliers. Finger springs from each of the arms will move the anterior segment forward, only you must give a compensating bend or your centrals will move more than your laterals. You can see the great adaptability of design that you have at your command. In constructing

*Reprinted from *The Dental Record*, October, 1925.

the appliance you solder on a section of your high labial, should you need it for future use in lining up the anterior teeth.

I will pass around an appliance with the high labial (photograph 3 is a sketch of the same), and you can see how adaptable it can be made by the use of finger springs; the "golf-sticks" have proximal contact and give distal and mesial movement.

For posterior cases a small hook is soldered on the lower molar crib when the appliance is originally made, and after we get the proper expansion of the segments of the arch in the upper, we shape our high labial and solder it free-hand on to the sections which were soldered on to the upper molar crib when



the appliance was originally made. We then attach our hooks for inter-maxillary force and the necessary finger springs.

There is no more favourable time for the correction of malocclusion of the teeth than during the period when the deciduous teeth are being lost and the permanent taking their place. In these cases the first molars often are not fully erupted and difficult to band, and the bite is so close that there is no space for the half-round tubes, but with this cribbing device the claws will hold the appliance firmly. I will pass around a model (photograph 4 is a sketch of same) which is an example of such a case. Here block movement of the teeth is not called for and only one cribbing device is necessary, as the teeth are in the period of eruption and the force need only be very slight.

One of the most decisive arguments in favour of this appliance is that which I have already pointed out to you, that there are many cases where the segments of the arch, especially the posterior segments, the premolars and the

molars, are in their proper buccal-lingual relation, their proximal contacts normal. We can move them *en masse* with this appliance, preserving their normal proximal contacts. Now we know, according to modern scientific thought, that if we move the teeth *en masse* the socket lining, lamina dura, etc., remain unchanged, and we get absorption of the adjacent cancellous tissue. We get movement of the teeth more quickly and retention is more assured than in individual tooth movement, where the moment we had spaced our teeth we have torn the dental ligaments and injured the socket lining and left it for nature to repair, which means longer retention.

Another decided advantage is that with this appliance we have a remarkable balance between anchorage and applied force; in fact our anchorage becomes an active anchorage, and here we do not need to worry about the stress we are giving our anchorage as when we used individual teeth, and we have the applied force under perfect control, regulating it by measurement, so that it may be a gentle physiologic-like force, and with this balance of anchorage and applied force we have the movement of the teeth so under our control that there is less possibility of unexpected secondary forces causing warping of the arches, elongations or depressions of the teeth.

Our forces of occlusion are always acting and aiding us in the correction of the occlusion, as no individual tooth is held so rigid that it cannot move in harmony with the others, and the inclined planes of all the teeth can come into action. The ease with which it can be inserted and removed and still remain perfectly firm during mastication can only be fully appreciated when you see the appliance in the mouth. Repairs and alterations can easily be made. Finger springs can be added or changed any number of times as the case progresses and you never need to put them all on at once, which makes it so complicated that they interfere with each other. The appliance makes an excellent retainer, being worn later only at night, and then once or twice a week as a control to detect any movement. And lastly I would call your attention to its hygienic advantages. But I do not need to dwell upon them; suffice to say it allows proper prophylactic care of the mouth. The appliances are removed after each meal, the teeth brushed and the appliance brushed with Sapolio, and the appliances are boiled once or twice a week in water with a lump of soda. The teeth can be kept clean and the mucous membrane of the mouth can be kept in a perfectly healthy condition.

It has not only been a matter of choice but necessity which has brought me to perfect myself in the technic of this removable appliance, for practicing in England where the children are away at school, and one can only see them during the holidays and perhaps once during the term, I must use an appliance with the advantages possessed by this appliance which I have enumerated above. If anything breaks or gets out of order they can send it to me for repair, or in expansion I can give the necessary millimetres, tighten the claws and return the appliance.

DISCUSSION

The President said the members had to thank Dr. Henry for giving them a very practical paper. Their recent papers had been "up in the sky," trying to find out what they ought to do, and speaking of theory, and just touching the "high spots." Dr.

Henry had brought them back to earth; had told them how he did things, and had shown them what he did when he wanted to get good results. Dr. Henry had given them a very practical paper, so that they had left theory and come down to practice, which was an everyday necessity with them. They also had to thank Dr. Henry for putting before them his very beautiful drawings and for exhibiting the appliances.

Dr. Barrows said he had had some experience of fixed appliances, and he must say that the majority of them, after they had been worn for two or three years, were a detriment to the patient. Crozat's Removable Appliance had many advantages. If the child happened to be out of town and the broken appliance was sent back, one could easily put it on the original model reassemble the parts, put in the necessary movements, and return it to the patient. That was a very great advantage. One particular point to be noted in connection with Crozat's appliance, was how the cribs were made. In other appliances the cribs got loose in a very short time and fell out. In Crozat's appliance there were two or three little tips which prevented the appliance going too far on to the gum, and kept it in place. He considered that Crozat's appliance was a most valuable thing, and he thanked Dr. Henry for having brought it forward.

The President said Dr. Barrows had brought out some of the practical advantages of Crozat's appliance. Personally, he had not had any experience at all with removable appliances. He was rather ashamed to say that, but personally he had always considered them such big and clumsy things. He had seen them in the mouths of people, and he had always thought to himself that he would never desire to put them in the mouths of his own patients.

Dr. Barrows said it was the highest technical art to construct such appliances, and those who had not had experience of them should consult Dr. Henry or pay a visit to America and obtain the technique, because it would be well worth their while to do so.

The President said two years ago in London, Crozat himself showed some of his appliances. Crozat had not been able to show many of them, as it had been an unexpected item on the programme, and the members then present had not got the full benefit which they might otherwise have got from Crozat's exhibition. He was quite certain that Dr. Henry's paper was going to be of benefit to everybody.

Dr. Hipwell thought the original cribs, especially when the teeth were short, would be a difficulty for some orthodontists who had not had the preliminary technique. Unless the manipulation of those first cribs was made with the most minute and scientific technique, there was going to be failure for the novice, but if the technique of making the first cribs when the teeth were short was mastered, a lot of trouble would be obviated and the practitioner would come to appreciate the appliance. Personally, he had seen the appliance for the first time that day, and he had said to Dr. Barrows that it was a very good thing. He now desired to get a little more of the technique. He had learned the technique of the lingual appliance from Jackson in 1911, in Berlin, but that appliance had been made with soft solder, and it was a very bulky and inefficient instrument. Crozat's appliance, however, was efficient, small, solid and durable.

Dr. Andresen said he could recommend the method, but he believed it was a very great improvement with the caps. It was an improvement on Jackson's method.

Mr. Harold Chapman desired to thank Dr. Henry for having brought before the Society Crozat's method of moving teeth. He had had the opportunity of seeing one of Crozat's appliances in operation, and it was doing its work most efficiently. He desired to ask two questions: the first one was, what was the thickness of the base wire; and the other was whether, in the few cases where the occlusion of the premolars was very close, there was any trouble or interference from the lower teeth or from the teeth of the opposite jaw biting on the crib wires?

The President said he saw somebody present who was a personal friend of Crozat, namely Dr. Oliver, and perhaps Dr. Oliver would say something on Crozat's work.

Dr. Oliver said he had hoped he would not have been called upon to discuss the particular appliance referred to by Dr. Henry. Dr. Henry had given a good paper and had shown some very nice drawings and some very nicely made appliances. There was no

universal appliance, and he did not suppose there ever would be. Every case was an individual case within itself, and the practitioner must select the proper appliance to do the proper work. The appliance under discussion had its advantages and disadvantages, as all types of appliances had. The main trouble which he would have with Crozat's Removable Appliance would be the child wearing it. If one could control the child so that the appliance was kept in the mouth all the time, one would get along very nicely; otherwise one was going to get into trouble. Children generally took the appliance off, laid it down, got it sprung, and then put it back into their mouths. That was the difficulty which practitioners found in America: they could not control their patients so as to keep them off sticky candies. Therefore, they had to resort to various types of attachments and preventions in order to control that. One criticism which he had of the appliance was as to keeping it in the mouth. Another criticism he had to make was that the auxiliary springs, which produced the stimulating tissue growth and development, were too large. They had to be large, however, in order to use this particular type of appliance; they could not be much smaller. He considered that the word "force" should be dropped from the vocabulary of the orthodontic profession, because if orthodontists used force they simply forced the teeth in position, which necessitated a long drawn-out period of retention and of wearing retainers. If the teeth were moved, as they should be from a biological and physiological standpoint, by stimulation, proper time being taken and proper rest-periods being given during the treatment, it would not be necessary for retainers to be worn. Personally, he had had some experience of the appliance under discussion, and Dr. Crozat deserved a good deal of credit for having brought it out, because there were indications for it. It worked beautifully in Crozat's hands, and he got good results. Dr. Henry was doing the same thing in England; but his own reasons for not using it were—first, the difficulty of keeping the appliance in the mouth in the right position; secondly, the auxiliary springs were too large and produced a certain amount of force and not stimulation; and thirdly, to a certain extent, individual tooth movement. He did not know how often Dr. Henry made adjustments of the appliance.

Dr. Henry said about once in three weeks, if he saw the patient; but usually it was once a month.

Dr. Oliver said he thought once in three months would be better. In his opinion if practitioners were to keep their hands more off their appliances and let Nature do a little bit more for herself, they would accomplish a great deal. He was convinced that the patient would be much better off if practitioners discontinued making so many adjustments every week or ten days or two weeks. The success of the appliance depended a great deal upon the patient. There was one thing which the orthodontic profession should impress upon patients—that they must keep their mouths clean. A patient under the care of an orthodontist should have less decay than one who was not under the care of an orthodontist. A practitioner generally did not see the average patient until treatment was necessary, whereas if a cavity was seen at the proper time it could very easily be taken care of. Personally, he did not believe that appliances caused decay if properly constructed. It was a statement generally made that appliances caused decay, but how could that statement be proved? Teeth decayed which never had an appliance in the mouth.

The President said the appliance which Dr. Henry had brought forward was a very interesting one because of the very fact that it was a sort of treatment *in absentia:* one could send away the patient and need only see him once in awhile. He desired to ask Dr. Henry whether he used the appliance in cases where he wished to have vertical movement, or whether he had recourse to a different kind of appliance in that case. (Dr. Henry said that he used a different appliance in that case.)

Dr. Henry, in reply, said he fully appreciated the points which Dr. Oliver had brought out in criticising the appliance. Practitioners in England had an advantage over practitioners in America, because the children in England were more under control: the English people had their children more under control than had the Americans. He was an American and he had to acknowledge it. Dr. Oliver had referred to the prophylactic care

of the mouth during regulation. It was remarkable how beautiful the mouth looked with one of Crozat's appliances. The mouth was in a nice, sweet, healthy condition, and the patients really took pleasure in brushing the appliance and in keeping it clean and their mouths. The crib device must be made of platinum wire, and it must be of 21 gauge; otherwise it would interfere with the occlusion.

A CASE OF EXPANSION OF A NARROW ARCH IN A CLEFT PALATE*

By J. Kenneth Grayson, L.D.S.

I MUST apologize for bringing forward an unfinished case, but it is Mr. Shipman's fault in calling on me, a rather junior member, for a communication. The history of the case, as far as I can gather from the patient's mother, is that the cleft originally involved the whole of the soft palate and about two-thirds of the hard palate, and for this she had three operations. The

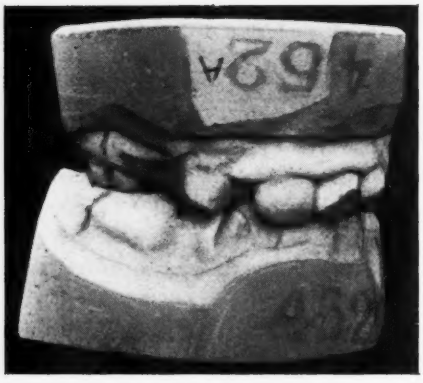


Fig. 1.

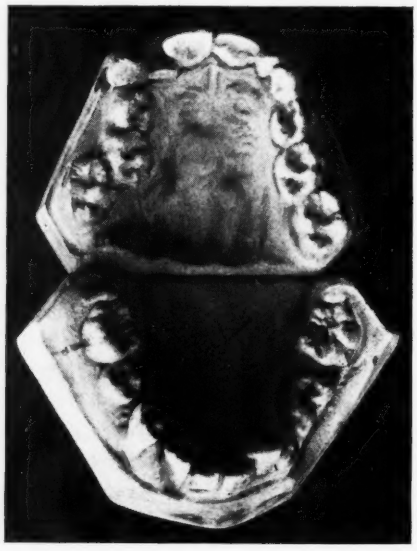


Fig. 2.

first at two years of age on the hard palate, was completely successful. The other two operations were on the soft palate, and both subsequently failed. The patient was first seen by Mr. Maxwell Stephens at nine and one-half years of age, and the condition was then as shown in the first slide. Two of the first permanent molars were carious, but it was decided to keep those two to prop the bite, as the deciduous teeth were all about to be lost, and try and expand the arches. She started treatment with Mr. White for her speech as soon as the obturator was made. The lower jaw was expanded with the usual type of Badcock expansion screw plate with finger springs on the molars. The upper plate was made in two stages. An ordinary model was

*Transactions of the British Society for the Study of Orthodontics.

taken of the hard palate and a vulcanite plate made to this with the various springs already in position. This was then fitted in the mouth and soft composition moulded in position to fill the cleft in the soft palate without causing any displacement of the surrounding soft tissue. A soft rubber obturator,

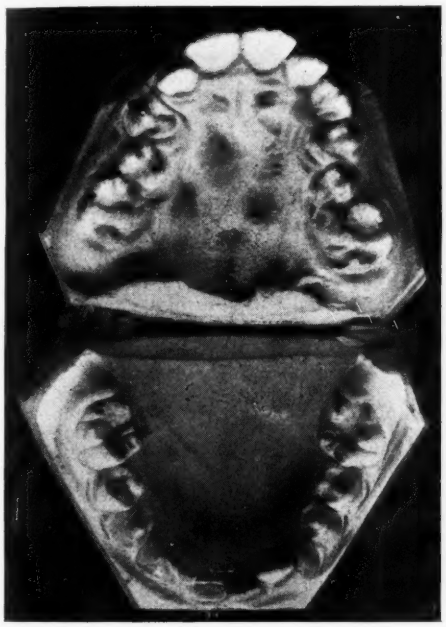


Fig. 3.

Fig. 4.

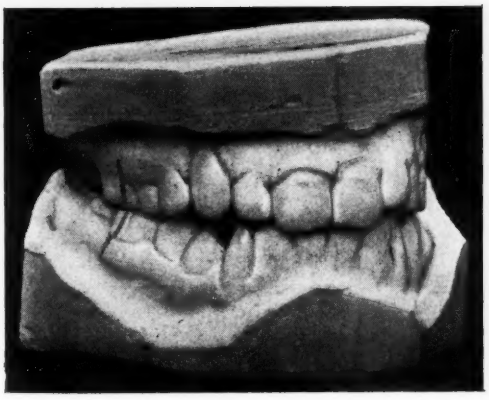


Fig. 5.

Fig. 6.

shaped like a small tea-scoop, was then vulcanized onto the first plate from this model. The wires on the upper plate at first consisted of full Jackson cribs over the molars with long finger springs attached mesially pressing the erupted molars outwards.

A further upper plate was then made in which the full cribs were placed around the premolars and the finger springs moved backwards to press the molars outwards and a small biting plane placed in the incisor region. The position is shown in the third slide. During this time the finger springs on the lower plate were adjusted to move the lower molars outwards. The start of the eruption of the upper right canine made a complication, but as the movement of the teeth and the arch had developed so well and her phonation had improved so markedly, it was decided to try and draw the incisors forward. This was attempted with finger springs on both plates and the canine is now coming into position. The treatment of the case has been carried out with great caution, and consequently has spread itself over a long period. The two molars have been carried on with cement fillings renewed from time to time. Only two other cavities, one in an upper premolar and the other in a lower incisor, have occurred, in spite of the appliance having been worn for so long.

DISCUSSION

Mr. Schelling asked the age of the patient at the present time.

Mr. Grayson said she was fourteen.

The President said the communication was a very interesting one, and the case showed an extremely good result. A matter of special interest was that Mr. Grayson had used small finger springs, which rather emphasized the point that perhaps orthodontists were apt to overlook from time to time, the fact that the attachments they used with fixed appliances could also be used with removable ones, and *vice versa*. If that was remembered practitioners might probably make things a little easier for themselves.

Mr. A. T. Pitts said that such cases as had been presented took a long time, and he appreciated the extremely fine results Mr. Grayson had obtained, and he congratulated him upon the case. An interesting feature was that Mr. Grayson had combined the orthodontic appliance with an obturator, which was a very good idea, although one would imagine it made the stability of the plate when in the mouth a little more difficult.

Mr. Maxwell Stephens said when the child was first seen there was a very poor occlusion, and the child was not developing at all well, and that decided him to expand the arch to get occlusion. Undoubtedly the child's health did improve when that was carried out. It led to a great deal of inclination of the teeth; there was not the same amount of translation, the teeth being very much inclined in their sockets.

REPORT OF THE EDUCATION COMMITTEE TO THE BRITISH SOCIETY FOR THE STUDY OF ORTHODONTICS*

List of Members of Education Committee: J. H. Badcock, Chairman; Norman G. Bennett, F. Bocquet Bull, Harold Chapman, Sheldon Friel, G. F. Cale Matthews, H. T. A. McKeag, G. Northcroft, J. Lewin Payne, Bertram Samuel, Sidney Spokes; A. T. Pitts, Secretary, 1922; Harold Chapman, Secretary, 1925.

TERMS OF REFERENCE.—To consider the present method of teaching orthodontics in Great Britain and Ireland, to report thereon and to make recommendations, if thought fit.

1. *The Need for Orthodontic Treatment and the Results Arising from Lack of Treatment.*

Irregularities of the teeth are frequently so gross as to constitute an obvious defect of feature often accompanied by perverted respiratory function, impaired biting power, and an increased liability to pyorrhœa and dental caries.

2. *The Present Deficiencies of Treatment.*

Admitting the necessity for the treatment of such cases, how is it met?

So far as a large section of the population is concerned, it is not met at all. A great number of children of the poorer classes do not receive any treatment. In the dental hospitals only a small fraction of those requiring attention receive it; in the school clinics such treatment is rarely undertaken except in so far as extraction of the teeth, unaccompanied by any supplemental regulation, suffices.

With regard to treatment in private practice, it would be a mistake to consider that the facilities for orthodontic practice are co-extensive with the number of practitioners. Actually many cases which could and should be treated, are not, even when the parents are willing to have it done. This branch of practice is not congenial to some dentists for various reasons, while there are others who would like to carry out orthodontic treatment but feel diffident of their ability.

Orthodontics is admittedly a branch of dentistry which not only calls for high technical skill, but also needs much experience in diagnosis and prognosis, and although many dentists may feel themselves competent to carry out the details of treatment, they do not always feel able to make the preliminary diagnosis which involves a decision as to the methods to be employed.

The student qualifies, knowing less of orthodontics than of any other branch of dentistry.

It stands somewhat apart from the rest of dentistry, and the evolution

*From the *Transactions* of British Society for the Study of Orthodontics, 1922 and 1925.

in skill and knowledge which every dentist may reasonably hope for, may leave his knowledge of orthodontics stationary.

3. *The Desirability of Instituting Special Instruction in Orthodontics.*

It is desirable that special instruction should be given in our teaching schools so that the student may at least know the elements of the subject. Knowing these, he will have a basis on which to build, and if he so desires, can set out to become specially skilled in orthodontics. If his desires should not lie in that direction, he would still be able to recognise his limitations in regard to difficult forms of malocclusion and the possibility of their treatment by those with a wider knowledge of the subject.

Out of this arises the question as to whether one member of the hospital staff should be entrusted with the whole of the teaching of orthodontics so that, in effect, he becomes the orthodontic specialist on the staff, or whether all members of the staff should take their turn in treating orthodontic cases and giving clinical instruction on their visiting days. In a few dental schools the former method is in vogue, but in the majority all members of the staff are, in theory, equally responsible for orthodontic treatment and instruction.

The Committee feels that there should be a member of the staff in charge of the orthodontic department, responsible for all treatment of the patients. The main body of the teaching to the students, both theoretical and practical, would naturally fall to this member of the staff. At the same time the Committee is of the opinion that it would be unwise to debar other members of the staff from teaching. This could be arranged without lessening the administrative authority of the dentist in charge of the orthodontic department.

The Committee suggests the following as a Model Scheme of Undergraduate Education in Orthodontics:—

A course of instruction in orthodontics should be compulsory and should include technical work, lectures and clinical work, as follows, viz.:—

1. *Technical work (in the laboratory, accompanied by lecture demonstrations).*

This course should consist of:—

(*a*) Casting impressions and the preparation of the model.

(*b*) Free-hand soldering technic and wire bending.

(*c*) The construction of plain bands to fit natural teeth, by direct and indirect methods.

(*d*) The construction of simple appliances, removable and fixed, on models and phantoms respectively.

(*e*) The construction of various devices to retain removable appliances.

2. *Lectures on the Theory and Practice of Orthodontics.*

These lectures should form a special course and not be included in the course of lectures on Dental Surgery. This is desirable so that orthodontics may not be submerged by the other subjects which must inevitably form the greater part of the syllabus of lectures on Dental Surgery, and to give it a position in the curriculum worthy of its importance.

With regard to the lectures themselves, it is obvious that their arrange-

ment and subject matter must vary with the views of the lecturer; nevertheless there is common ground as set forth in the following syllabus:—

1. The definition and aims of orthodontics.
2. A short history of the subject.
3. Definition of terms and phrases.
4. Morphology.
5. Normal development, growth and relationship of the jaws and associated bones and teeth and the natural forces which influence them.
6. Forces governing the eruption and arrangement of the teeth.
7. Normal occlusion and the factors producing it.
8. Normal variation.
9. Effect of function on form and growth.
10. Etiology of malocclusion: (1) Hereditary causes.
    (2) Congenital "
    (3) Pathological "
    (4) Functional "
    (5) Dietetic "
    (6) Local "
11. Models, x-rays and photographs.
12. Diagnosis and Classification.
13. Prognosis.
14. Treatment: (1) Preventive.
    (2) Remedial. (*a*) Surgical
    (*b*) Mechanical
    (*c*) A combination of both *a* and *b*
    } Retention.
15. Factors influencing the choice of treatment.
16. Case recording, charts, and preservation of data.

3. *Clinical Work.*

The student should hold a dressership of not less than three months in the orthodontic department.

This should comprise instruction in:—

(*a*) The taking of impressions in plaster and other materials.
(*b*) Diagnosis and charting.
(*c*) Treatment by extraction.
(*d*) By surgical methods other than extraction.
(*e*) By appliances.
(*f*) By a combination of any or all methods (*c*), (*d*) and (*e*).

At the end of each course of lectures a class examination is desirable.

It is earnestly recommended that greater stress should be laid on this subject, and that orthodontics should form a separate subject in the examination for a diploma or degree.

POSTGRADUATE INSTRUCTION IN ORTHODONTICS

There should be facilities for postgraduate instruction in orthodontics in connection with all dental schools. Postgraduate teaching might be of two classes:—

(*a*) As for undergraduates, with such modifications as might be necessary to meet special conditions.

(*b*) A more detailed course for those fitted to receive it.

Courses for short periods held at times which might be most convenient to dentists in practice, would probably be found the most suitable arrangement and meet a much-felt want. This would necessitate special classes in practical and theoretical work apart from those held for the benefit of the students.

(Signed) J. H. BADCOCK, *Chairman.*

APPENDIX

The following expanded syllabus is suggested as a guide for teachers and may be varied to suit the curricula of various schools and examinations, e.g., the L.D.S., B.D.S., etc. The numbers of the headings in the appendix will be found to correspond with the numbers in the model scheme. The appendix concludes with suggestions for case-taking and the references, which are referred to by numbers at the end of each section of the appendix.

1. TECHNICAL WORK IN THE LABORATORY, ACCOMPANIED BY LECTURE DEMONSTRATIONS

The taking of plaster impressions, e.g., one student by another student.

Casting impressions and the preparation of the models.

Free-hand soldering technic and wire bending, e.g., soldering a circle of wire inside a square inside another circle.

The construction of plain bands for anterior teeth.

Labial "pull-to" joint or "squeeze" joint; lingual "pull-to" joint, "overlap" joint.

The construction of plain bands for posterior teeth by the (i) direct method, (ii) indirect method.

The construction of simple appliances, removable and fixed, on models and phantoms.

The construction of various devices to retain removable appliances.

2. LECTURES ON THE THEORY AND PRACTICE OF ORTHODONTICS

1. *The definition and aims of Orthodontics (Dental Orthopædics, Odonto-Prosopic Orthopædics):—*

Orthodontics includes the study of the growth and development of the jaws and face particularly, and the body generally, as influencing the positions of the teeth, the study of the action and reaction of internal and external influences on this development, and finally the prevention and correction of perverted and arrested development. The aims of orthodontic practice are to

obviate the evils set out in the first part of this report, and should be both preventive and curative.

References: Nos. 1, 2, 3, 4, 5, 15.

2. *Terms and phrases should be defined as they arise, special attention being paid to the following:—*

(1) "Science," (2) "Heredity," (3) "Phylogeny," (4) "Ontogeny," (5) "Recapitulation Theory," (6) "Morphology," (7) "Growth and Development," (8) "Physiological and Chronological Ages," (9) "Function," (10) "Diagnosis," (11) "Prognosis."

Great confusion results from the loose use of such terms, both in understanding problems and in conveying ideas to others.

3. *The Morphology of the Deciduous and Permanent Teeth:—*

A knowledge of the form, grooves and cusps of the teeth is essential in the study of occlusion.

References: Nos. 6, 7.

4. *Embryology of the Face and Jaws; showing how particular forms in later life may represent survivals of embryonic stages.*

Reference: No. 8.

5. *Development, growth and relationship of the jaws, associated bones and teeth, and the natural forces which influence these.*

I. Anatomy of cementum, periodontal membrane, alveolar and basilar bone.

II. The physiology of the following:—

(A) Periodontal membrane.

(B) Bone.

(i) Limited as to its growth and development by heredity, but modified as to its form and structure by function and nutrition.

(ii) Differentiation between—

(*a*) bone depending wholly on function for its development, e.g., alveolar bone, which is dependent on the presence of teeth and modified according to the stresses to which these are subjected; and

(*b*) bone (e.g., basilar bone), in the full development of which both heredity and function play a part.

(iii) Adaptability of form and structure of bone.

(iv) Wolff's Law of Bone Transformation.

(v) Oppenheim's Experiments.

(C) Muscles.

(i) Group and counter-group system, showing that muscles do not act singly.

(ii) Development of antagonising muscle groups.

(iii) Muscle tone.

(iv) Muscle less adaptable than connective tissue structures, e.g., bone.

(D) Eruption of Teeth.

References: Nos. 9, 10, 11, 12, 13, 14, 15, 16, 17, 17A, 17B, 17C.

6. *Factors influencing the arrangement of the teeth, e.g.:—*
   Approximal contact points.
   Interdigitation of cusps.
   Muscular pressure.
   Heredity. (See 9 I.)
   Habit. (See 9 II.)
   References: Nos. 5, 6, 7, 21, 30.

7. *Effects of function on form and growth.*
   Reference: No. 17.

8. *Occlusion.*
   I. Definition of occlusion.
   II. Occlusion the basic principle of orthodontics.
   III. The functional significance of the surface detail of each tooth.
   IV. Meaning of the word "normal."
   V. Three standards of occlusion: (1) Hypothetical ideal, (2) Typical, (3) Functional.
   VI. The functional standard governs all conceptions of treatment, whether that function be mastication, respiration or speech.
   References: Nos. 18, 19.

9. *Some factors influencing occlusion.*
   I. Heredity:—
      (A) Weissman's Theory; Mendelism; Neo-Lamarckism.
      (B) Inborn and acquired characters; environment.
      (C) Mutations and reversions.
      (D) Variations.
      (E) Quantitative and Qualitative, Continuous and Discontinuous Variations.
   II. Habit:—
      (A) Tendency to repetition a normal characteristic of living tissue.
      (B) Influence of habit on function a large factor in determining development.
   III. Normal Variation.
      (A) Individual occlusion a problem of normal variation. Application of Law of Variation lies in distinction between individual variation and malocclusion.
   References: Nos. 20, 21, 22, 23.

10. *Etiology of malocclusion.*
   I. Heredity.
   II. Congenital conditions.
   III. Pathological conditions.
      (A) Effects of Constitutional Diseases.
      (B) The effect of abnormal internal secretions on growth and development of the teeth and jaws.

IV. Functional causes; Habits; Muscularity.
V. Diet considered chemically and physically.
VI. Local conditions which interfere with the development of the jaws and alignment of the teeth.

References: Nos. 1, 2, 15, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34.

11. *Models, X-rays and Photographs.*

12. *Diagnosis and Classification.*

Classification of malocclusion:—
Angle's, Bennett's, G. Villain's.
Terms used to denote malocclusion.
Methods and instruments employed, e.g.:—
Prosopometer; Symmetroscope; Dynamometers.

References: Nos. 1, 2, 15, 35, 36, 37, 38, 39, 40.

13. *Prognosis.*

Age, Heredity, Social conditions, Health and Personal characteristics.

Reference: No. 41.

14. Treatment.

I. Preventive.

(A) Care of deciduous dentition.
(B) Extraction of deciduous teeth.
(C) Splints after loss of deciduous teeth.
(D) Cure of bad habits.
(E) Surgical (adenoids and tonsils, etc.).
(F) Diet.
(G) Exercises.

II. Remedial.

(A) Surgical. Extraction, immediate rotation and translation.
(B) Mechanical.
Mechanical principles employed in orthodontic appliances.
Action and reaction.
Resultant of forces.
Levers, orders I, II, III.
Elasticity.
Inclined planes.
Wedges.
Anchorage: Definition and application.
Simple, stationary, reciprocal, etc.
Relation of the physiology of dental and associated structures to the design of orthodontic appliances.
Physiology of tooth movement.
Necessity for minimum interference with function.
Appliances for the development of normal function.
Materials used in fixed and removable appliances.
Properties of materials as applied to various purposes.
Exercises.

(C) A combination of (A) and (B).

The importance of hygiene during treatment.

References: Nos. 1, 2, 3, 4, 42, 43.

15. *Factors influencing the choice of treatment.*

I. Age.

II. Attendance.

III. Health conditions, dental and general.

IV. Social conditions.

Reference: No. 44.

16. *Case recording, charts and preservation of data.*

References: Nos. 15, etc.

3. Case-taking

(*Vide* suggestions at the end of the Syllabus.)

4. Clinical Work

This should comprise instruction in:—

(A) The taking of impressions in plaster and other materials.

(B) Diagnosis and charting.

(C) Treatment by extraction.

(D) By surgical methods other than extraction.

(E) By appliances.

(F) By a combination of any or all methods (C), (D) and (E).

SUGGESTIONS FOR ORTHODONTIC CASE-TAKING

Number. Date of Examination. Patient's Name. Age. Sex.

General History

Diet.—*First Year.*—Natural. Artificial. Mixed. What foods? *Years* 1-6. *Present Time.*—Breakfast. Dinner. Tea. Food after tea. Sweets. Fruit.

Breathing.—Day. Night. Windows at night. Shut. Open. If by mouth state: (1) Cause; (2) Age of onset; (3) Degree; (4) Date when nasal breathing re-established.

Nose.—General development. Anterior Nares (Right—Free; Obstructed. Left—Free; Obstructed).

Tongue.—Small. Large. Muscular. Flabby.

Lips.—Small. Large. Muscular. Flabby.

Habits.—Harmful, e.g. thumb-sucking, lip-sucking, etc.

Correlated Habits.

General Health.—Physique. Sitting height. Total height. Weight. Tonsils—Healthy; Diseased. Adenoids—Absent; Present. Illnesses. Hereditary Factors.

Dental History

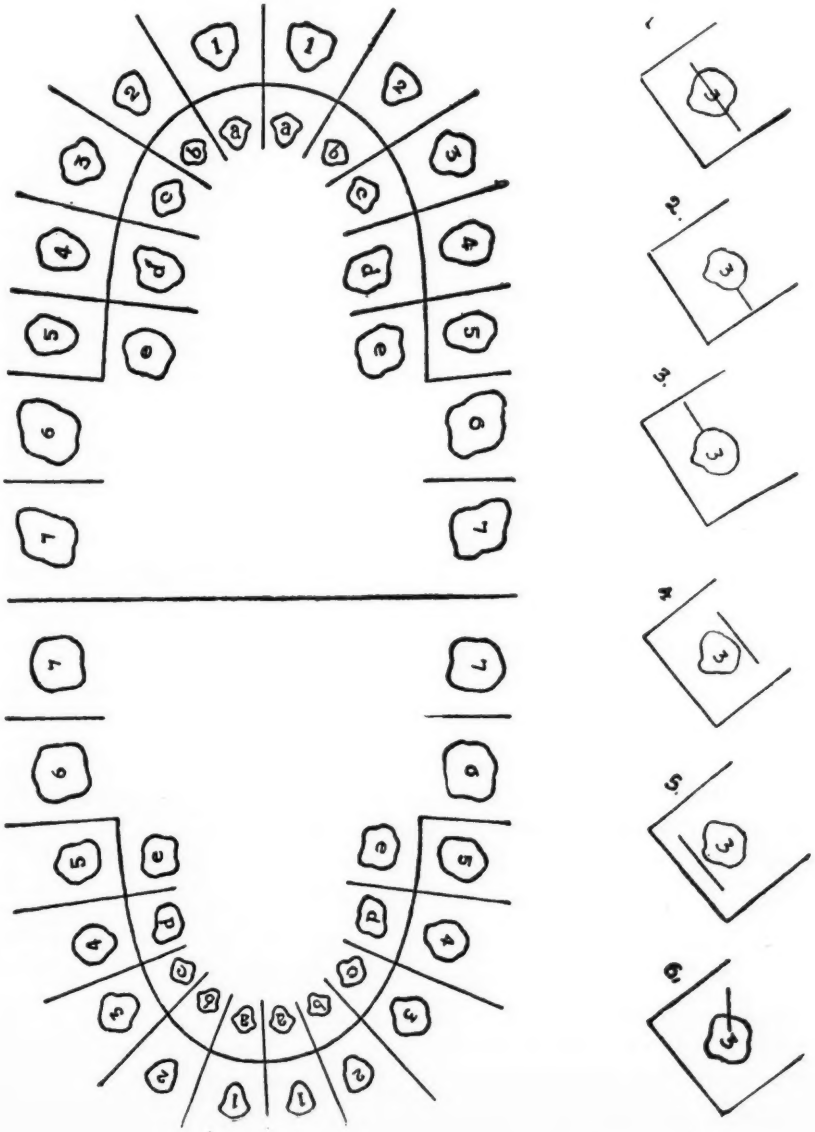
General condition of the Mouth—Clean; Dirty. Use of Toothbrush. Developmental defects of teeth. Gums. Frœna. Caries—Absent; Degree. Deciduous teeth retarded in eruption. Permanent teeth retarded in eruption. Deciduous teeth retained. Teeth erupting out of recognized order. Deciduous teeth spacing naturally—Yes; No. Supernumerary teeth. Radiographs show. Date. Photographs—Front, right and left profile. Note the variation from normal in the patient's face. Date. Mastication—Normal; Vigorous; Feeble. Orthodontic family history.

Indicate on a chart the position of each tooth.

INSTRUCTIONS FOR COMPLETING CHART

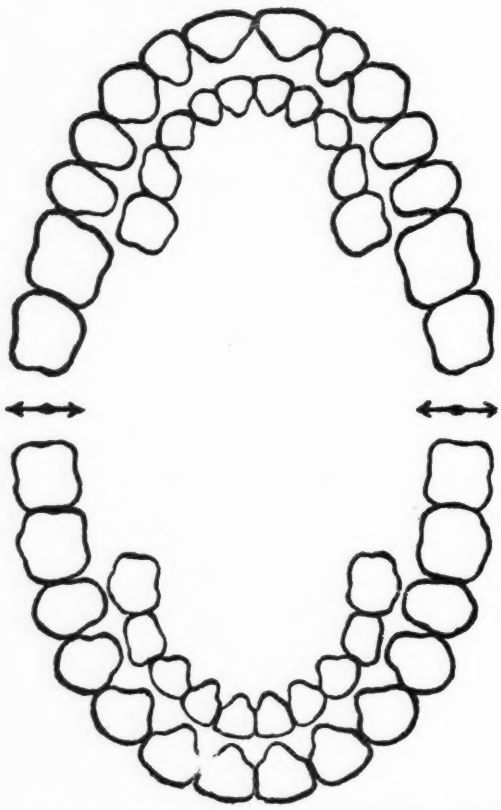
1. If the tooth is in its normal position draw a line through the numeral at right angles to the numeral.
2. If the tooth is in a position mesial to normal draw a line at right angles but distal to the numeral.
3. If the tooth is in a position distal to normal draw a line at right angles but mesial to the numeral.
4. If the tooth is in a position labial or buccal to normal draw a line at right angles but labial or buccal to the numeral.
5. If the tooth is in a position lingual to normal draw a line at right angles but lingual to the numeral.
6. If a tooth is in a rotated position draw a line at the angle and position of rotation.

Draw a diagram of the occlusion of the teeth (right and left sides) and make a note of the antero-posterior relation— of $\frac{6|6\ 3|3}{6|6\ 3|3}$ and $\frac{e|e\ \ c|c}{e|e\ \ c|c}$ or



Indicate on a chart the following:—

Teeth lost	by ×
Teeth congenitally absent	by □
Teeth erupting	by Λ
Caries by outline of cavity	
Fillings by outline blocked in	
Roots, carious	by rt.
Pulp involved	by p.
Hypop'asia	by H.



General Characteristics.—Body—Broad; Slender. Face—Square; Round; Oval.

Relation of Arches to Cranium and Face.*—*Antero-posterior.*—Upper—Normal; Post-normal; Pre-normal. Lower—Normal; Post-normal; Pre-normal.

General Character of Dental Arches.*—*Antero-posterior.*—Upper—Normal; Short; Long. Lower—Normal; Short; Long. *Lateral.*—Upper—Normal; Narrow; Broad. Lower—Normal; Narrow; Broad. *Vertical.*—Upper—Normal; Deep; Shallow. Lower—Normal; Deep; Shallow. *Centre Line.*—Upper—Correct; to the right; to the left. Lower—Correct; to the right; to the left. *Overbite.*—Edge to edge; Slight; Medium; Excessive. Note drifting of teeth from normal positions.

Classification—Angle; Bennett.

Summary of previous facts—Etiological; Diagnostic.

Prognosis (give reasons).

Suggested Treatment.

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Abbreviations.—*Trans.* B.S.S.O. = *Transactions* of the British Society for the Study of Orthodontics. *B.D.J.* = *British Dental Journal. D.R.* = *Dental Record. J.D.R.* = *Journal of Dental Research. I.J.O.* = *International Journal of Orthodontia. D.C.* = *Dental Cosmos.*

*Measurements should be given where possible.

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DEPARTMENT OF

ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

NITROUS OXIDE-ETHYLENE-OXYGEN ANESTHESIA FOR EXODONTIA AND ORAL SURGERY

By Robert Friedman, D.D.S., New York City

AN HISTORICAL SURVEY

ETHYLENE was first discovered by Thomas Nunnely, an English surgeon of Leeds, in the year 1849. It was at the time when Sir James Y. Simpson introduced chloroform into medical practice in England. That was the great period of the birth of general anesthesia. Agents were administered to eliminate consciousness, with the subsequent loss of pain sensations during surgical procedures. Wells and Jackson had discovered and had already introduced nitrous oxide as an anesthetic agent. The terrific struggles and animosities that embittered their lives, because of the disputed recognition, is not our concern here. Suffice it to say that nitrous oxide, first given alone, and then with the addition of oxygen, as nitrous oxide-oxygen anesthesia, has given the world the safest general anesthetic as yet known. Ethylene was entirely forgotten after several years of early experimental work. It was discovered by Dr. Arno B. Luckhardt of Chicago, who thereby rediscovered it for the world as he had had no previous knowledge of its use.

Dr. Luckhardt carried on animal experimentations from 1918 to 1922 before he used it to anesthetize human beings. After having had this gas administered to himself by his coworker Carter and in turn having administered it to Carter in the presence of surgeons and physicians at the Presbyterian Hospital of Chicago, they proceeded to use it as an anesthetic agent. In April, 1923, Luckhardt and Carter reported the first 106 cases that had been operated upon during the administration of ethylene as the anesthetic agent. This also took place at the above-mentioned hospital.

Since the pioneer work of Luckhardt and Carter, there have been other workers in this field of anesthesia, by such men as J. T. Gwathmey, W. E.

Brown, J. H. Cotton, and J. S. Lundy in the medical field, while J. F. Christiansen and M. Ecker have done considerable work in the dental field. It has been adopted and used with gratifying success by this author also.

COMPOSITION

Ethylene (C_2H_4), or Olifiant Gas, as it was known years ago when first discovered, is prepared by allowing absolute ethyl alcohol to pass over hot sulphuric acid, orthophosphoric acid or kaolin which act as catalytic agents.

$$C_2H_5OH \text{ plus heated } \left\{ \begin{array}{c} H_2SO_4 \\ \text{or} \\ H_3PO_4 \\ \text{or} \\ \text{Kaolin} \end{array} \right\} = C_2H_4 \text{ plus } H_2O$$

It is liquefied under pressure and stored in tanks similar to those used for oxygen and nitrous oxide.

PHYSIOLOGY

We normally inspire air. This air is a mechanical mixture of three principal gases, namely, nitrogen, oxygen and carbon dioxide. There are several other gases in the air, but their percentage is so small that they are not to be considered in any way as influencing factors in respiration. The main factor to be considered is the indisputable fact that before inspiration the air contains 20.96 per cent of oxygen and only 0.04 per cent of carbon dioxide. During expiration, however, the same air contains 16.02 per cent of oxygen and 4.38 per cent of carbon dioxide and the balance in water vapor. The nitrogen content remains stable.

		N	O	CO_2
Example:	Inspiration	79.	20.96	0.04
	Expiration	79.	16.02	4.38 and vapor

During nitrous oxide-ethylene-oxygen anesthesia approximately the same conditions hold. It has been ascertained that it is necessary to administer about 20 per cent of oxygen with the anesthetic gases to maintain the patient in a normal physiologic state of well-being during the period that the anesthesia is being maintained. Instead of the nitrogen of the air, ethylene is inhaled into the lungs to be then absorbed by the blood stream.

It has not yet been determined whether this gas forms a chemical union with the hemoglobin of the blood or whether there is only a physical absorption of the gas by the cytolytic elements of the blood stream. It is thought that it only forms a physical union.

When ethylene reaches the brain it seems to affect the cortical centers controlling the voluntary muscles of the body. Muscular relaxation begins to evince itself during the second or analgesic stage of anesthesia. This is one of the most important factors resulting from its use. The lower extremities seem to be affected first, gradually affecting the upper ones. When complete muscular relaxation has occurred, the patient is snoring quietly as though in

a deep sleep. The third stage, or surgical anesthesia, has been obtained. This is usually light as the eye reflexes will still manifest themselves. They are completely eliminated by permitting the prolongation of the anesthesia. During the anesthesia or subsequent to it no evidence of its effects are noted in the cardiovascular-renal system. Nor is there any rise in the blood pressure. To the contrary, it has been observed that the blood pressure falls several millimeters of mercury.

PRELIMINARY TREATMENT

Before any general anesthetic is administered it is the duty of the anesthetist to properly prepare the patient. This preparation will aid the induction, make the anesthetic risk considerably less and will avoid undue and unpleasant after-effects. The treatment is subdivided into three parts; Hygienic, Psychic and Medical.

Hygienic Treatment.—Cleanliness is the first prerequisite. Whenever possible the mouthwash is advisable. Every movable or removable appliance must be removed from the mouth before the mouth-prop is placed in position. An empty stomach will eliminate the possibility of vomiting. The best time for administration of the anesthetic is in the morning. During these preparations the patient is to be treated psychically.

Psychic treatment is to be administered by giving the patient a feeling of certainty. The manner in which the anesthetist conducts himself, giving every evidence of sureness and ability, has a remarkable effect upon the patient. When necessary, the anesthetist must allay the fears of the patient to obtain that cooperation which is so essential to a good, smooth anesthesia. This is best accomplished by kind words plus gentle actions. Should the results be negative we must resort to premedication.

Premedication.—It has been found that, when $\frac{1}{8}$ gr. morphine sulphate and $\frac{1}{150}$ gr. atropine sulphate or when 0.05 gm. ($\frac{3}{4}$ gr.) of procaine is dissolved in a solution of magnesium sulphate, either 25 per cent or 50 per cent, and given hypodermically, the action will be synergistic to such an extent as to facilitate anesthesia. It becomes easier to administer the anesthetic, less gas will have to be used and the return will be unaccompanied by vomiting, pain and psychic activity. The injection is given into the arm about 20 minutes before the commencement of the anesthesia.

ADMINISTRATION

Nitrous oxide-ethylene-oxygen anesthesia can be given where any other anesthetic is contraindicated. Up to the present time no contraindications for its use have been discovered.

The mouth having been properly cleansed, with instruments and all necessary appliances in readiness, with the mouth-prop previously selected and a throat-jack ready, we proceed to examine the mouth again to be certain that all movable appliances have been removed. We again view the part to be operated upon, forming a mental picture of what is to be done so as not to err during the operation. The mouth-prop is now inserted into the mouth between the upper and lower teeth of the unmolested side. The nasal inhaler, which is used

exclusively by the author, is properly adjusted and the gases are administered. We can use the arm as our guide to anesthesia, because, as stated above, muscular relaxation takes place. We prefer to have the patient raise the left arm.

The anesthesia is begun with the air and rebreathing valves open. The oxygen valve is now so adjusted as to deliver 20 per cent of this gas (2 holes of the sight feed) and the nitrous oxide valve is adjusted to deliver 80 per cent of the gas (4 or 5 holes). When this is done both the air and rebreathing valves of the inhaler are closed. The two gases pass through the water of the sight feed to which we have previously added 10 drops of a 25 per cent solution of oil of bitter orange. This oil of bitter orange disguises the odor of the gases, thereby producing a pleasant psychic affect upon the patient.

We permit about eight or ten inhalations of this mixture, at which time the patient has passed to the beginning of the second stage of anesthesia. We now begin to deliver ethylene to the patient, adjusting the valve so as to give 80 per cent of the gas (4 holes). Simultaneously the nitrous oxide is discontinued. It will be observed that the arm is dropping limpidly by the side of the patient. *The color of the patient should be pink at all times.* When that quiet snoring is heard, even though the eye reflex is present, we have the patient in the third, or surgical, stage of anesthesia. The depth of anesthesia depends upon the length of time we wish to maintain this state of insensibility to pain. For short operations, a light anesthesia is advisable, whereas for prolonged cases a deeper anesthesia would be our choice. The patient must be watched for color. *Cyanosis is never to be permitted, as it is the danger signal.* It has been found that when once the patient's index is determined, it is unnecessary to alter the flow of the gases. Rebreathing produces a deeper anesthesia with less gas; a sufficient amount of the mixture being exhaled through the mouth during the operation even though the throat-pack is in position. Rebreathing also produces a sufficient amount of carbon dioxide to maintain even respiration.

Before the operation is begun, a throat-pack should be placed into the oropharynx. This pack serves two functions; the first being that of preventing objects from slipping into the larynx and the second that of preventing mouth-breathing to disturb the anesthesia.

ADVANTAGES AND DISADVANTAGES OF ETHYLENE

The advantages gained by substituting ethylene for nitrous oxide can be summed up in the following manner; viz.,

1. Ease of Induction.
2. Muscular Relaxation.
3. Absence of Cyanosis.
4. Absence of Sweating.
5. Absence of Respiratory Irritation.

The disadvantages are:

1. Inflammability of the gas.
2. Explosibility of the gas.
3. Oozing of the blood more marked only during administration.

The first two factors can be eliminated by invoking ordinary precautions, such as not permitting the lighting of matches, smoking, having fires from Bunsen burners, *not using an electric cautery* or *having exposed electrical connections near the chair*. These precautions must always be taken. The third factor can be readily overcome by injecting from 3 to 5 drops of adrenalin in 2 c.c. of normal saline into the area to be operated upon when feasible or possible. This is to be done when the patient is anesthetized so as to avoid any repulsion to the patient.

EMERGENCY PREPARATIONS

Whenever a general anesthetic is given a certain risk is assumed. The life of the patient is in the hands of the anesthetist during the entire time that the anesthesia is in progress. It therefore becomes encumbent upon us to be properly prepared for any emergency that may arise. The tongue may fall back into the pharynx and prevent breathing. A pair of tongue forceps should be ready with which to correct this condition. The patient may suddenly stop breathing or become cyanotic from an overdose or an unnoticed pathologic condition. In this event the ethylene gas must be shut off and the oxygen must be forced into the lungs. We must be prepared to resort to artificial respiration, the technic of which should be known to every anesthetist. Hypodermic medication may sometimes prevent a moribund condition if administered immediately. We suggest that a syringe with a mounted needle and an ampule of camphor in oil be at hand for immediate use when such an emergency arises.

Although there may never be an occasion for the use of these precautions, they are, nevertheless, essential for two good reasons. Should they be needed, they are always at hand ready for use. If a fatal case should occur and an attempt be made to attach legal responsibility, the presence and knowledge of the use of these precautions will and does play a major rôle in attaching or detaching this responsibility.

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ORAL PROPHYLAXIS IN ORAL SURGERY

By Robert Friedman, D.D.S., New York City
(Dental Surgeon St. Luke's Hospital)

Loss of the teeth in many individuals results from complete disregard of oral hygiene. The habit of cleaning the mouth should be instituted at the earliest possible age by the parents, guardian or nurse. Proper cleaning and subsequent care usually exempt most people from surgical interference until a late period in life.

In civilized communities the removal of teeth becomes inevitable because of odontalgia or some form of pericemental derangement or infection. It then becomes the duty of the dentist to institute oral prophylactic measures.

When surgical interference is contemplated, the operator should commence by cleaning the offending tooth. All concretions, accretions and general accumulations of débris must be removed. This can best be done with scalers. The part is then disinfected, usually by applying tincture of iodine, after which the anesthetic is administered. If a local anesthetic is used, the solution should never be injected near or into the gingival trough. The best location to inject the solutions is into the mucobuccal fold which is always a safe distance from the ordinary locations of oral infection. Aside from the superior results obtained with this technic, the dangers of injecting bacterial infection into the soft tissue with the solution are materially decreased.

Even though the tooth to be removed is cleansed in a general way, it frequently happens that elements of infection are present that are unavoidably forced into the socket and its surrounding areas. Generally benignant nature guards against the unpleasant results that follow in the wake of such unfortunate accidents and no ill effects manifest themselves. From time to time, however, we are compelled to contend with infections from this source. The best known way to avoid such contingencies is to swab the socket with a solution of 25 per cent argyrol, or protargol 10 per cent. Immediately following this, it is well to irrigate the wound with a mild wash that is an antiseptic astringent and that has the power of inducing blood coagulation. A 1:500 solution of potassium permanganate will fulfill these requirements.

Following these prophylactic measures by the attending dentist, it becomes necessary that the patient be instructed in the subsequent care of the mouth. This is probably the most important part of the entire procedure. Because of soreness, pain or both, the patient will often neglect oral hygiene measures unless advised as to the dangers of such uncleanliness. Those who never clean their mouths (and there are very many) will surely avoid such an odious duty to themselves, and those who do not follow the path of oral cleanliness are deterred because they are not properly instructed as to the course to be followed.

Unless another mouthwash is indicated, I direct the use of a normal saline solution with the addition of a teaspoonful of lime water. This is known to be the best combination, having marked antiseptic and astringent powers. It should be used intermittently as directed by the dentist. Instructions are always given to brush the teeth and contiguous tissue with a small soft brush or a rubber appliance. I always designate a rubber brush. From personal experience of four years of continual use, I believe that this type is the best that can be used at all times, and particularly following postoperative work. Because of its flexibility and ease of manipulation, it causes no pain or irritation to the mucous membrane.

I never specify a dentifrice as I believe that the preparations subserve but one function, that of a mechanical cleansing agent. I do however, condemn those dentifrices for which the manufacturers make unwarranted claims. This is a matter of individual discretion on the part of the members of the profession which, I feel, they should always exercise.

SUMMARY

1. Cleanse the tooth to be removed before administering the anesthetic.

2. Cleanse the socket with an antiseptic medicament followed by irrigation as outlined.

3. Instruct the patient in postoperative prophylaxis.

4. Impress the need of oral hygiene to preserve the teeth and their investing tissues.

GUN-SHOT WOUND OF MANDIBLE IN CIVILIAN PRACTICE. CASE REPORT

By Phil. L. Schwartz, D.D.S., New Brunswick, N. J.
Oral Surgeon to St. Peter's General Hospital

J. G., male, white, age thirty-eight, Italian, was brought to the hospital, September 11, with a gun-shot wound of the mandible. He had been out with some friends who had been imbibing liquor freely and, upon escorting one

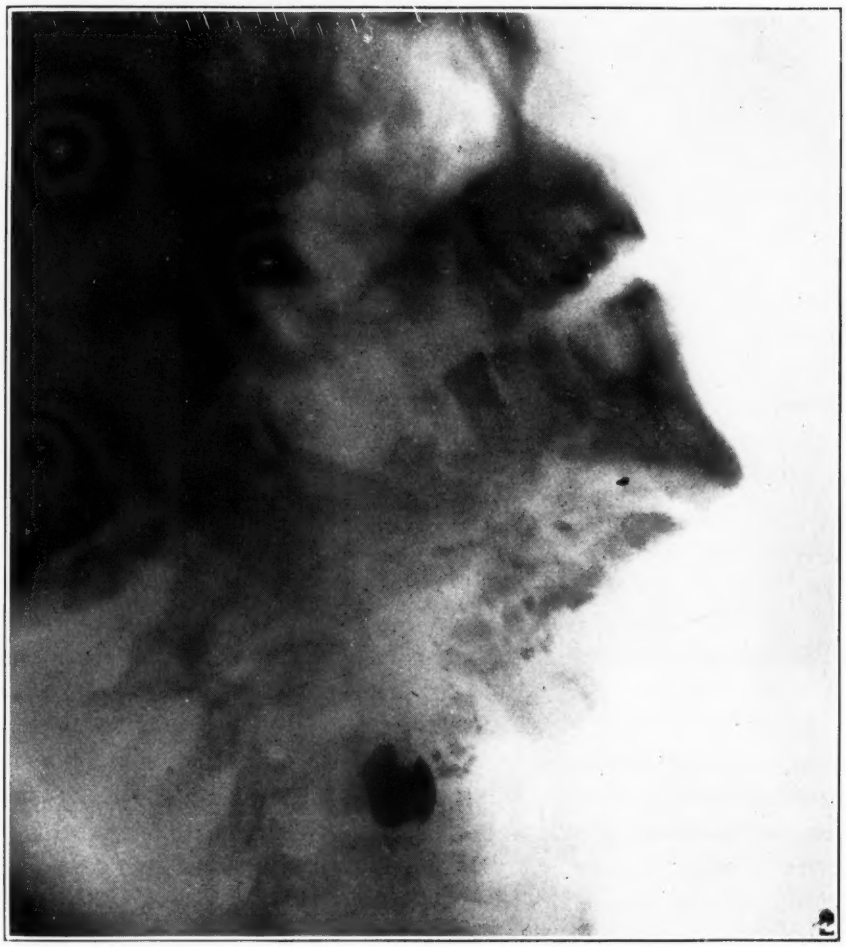

Fig. 1.

of them home, was shot with a rifle. The accompanying radiograms disclose a compound comminuted fracture of the right side of the mandible anterior to the third molar.

The injured area was infiltrated with a 2 per cent solution of novocaine, and three pieces of lead were removed from the region immediately below the

body, together with several spicules of bone. The fracture was then reduced by means of wiring the maxilla and mandible in the premolar and molar regions, using brass ligature wire. The wounds were dressed each day, there being a very copious and offensive discharge.

Fig. 2.

The patient was released from the hospital September 28 at his request, a slight discharge still persisting, and the jaws still being wired. I have not seen him since his discharge since he lives in another locality, where treatment is being continued.

ABSTRACT OF CURRENT LITERATURE

Covering Such Subjects as

ORTHODONTIA — ORAL SURGERY — SURGICAL ORTHODONTIA — DENTAL RADIOGRAPHY

It is the purpose of this JOURNAL to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Focal Infection in Obstetrics. R. Friedman (New York). The Dental Outlook, February, 1926, xiii, 2.

The author, who is dental surgeon to St. Luke's Hospital, N. Y., discusses the relation of puerperal eclampsia and spontaneous abortion to possible oral or other focal infection. It is suggested in the volume on therapeutics by Osborne and Fishbein that eclampsia—including doubtless the other toxemic states of gestation—may have such an origin. As for spontaneous abortion it is almost a natural termination of a large per cent of conceptions, placed by some as high as twenty. When abortion is of the recurrent type it should be easier to bring it into association with factors like focal infection because should this focus be removed the patient ought to be cured of her habit of aborting. The mystery attendant on the two conditions, gestational toxemia and spontaneous abortion, may suggest something in common between the two, although they do not at all coincide—in fact in the pregnancy toxemias an abortion might save the patient but this almost never takes place. The author reports four cases of habitual abortion apparently cured through removal of a focus of infection; these are not personal cases but were originally published by Dr. A. H. Carter of Chicago, a practicing physician in the *Journal of the American Medical Association* for April, 1925. The author has been in correspondence with Dr. Carter and is probably the first to bring the subject directly before the attention of the dentists. The four cases run to the same type—a badly infected mouth with history of repeated abortions (as high as 11!), removal of purulent foci from the apices and (in one case) frontal sinus; and birth of normal children afterwards. The infecting germ was thought to have been the Streptococcus viridans—proved in one case.

Craniofacial Injuries of Boxers and Jaw-Protecting Apparatus. S. Palazzi (Pavia). Zeitschrift für Stomatologie, October, 1925, xxiii, 10.

The authors first mentions the chief blows, the upper cut which is directed against the chin, and the swing, cross and hook which are directed anywhere—mandible, chin or face at large. The upper cut must land on the chin because it is directed upward from below the chin level. It is usually the knockout blow and in addition, since when it lands the mouth may be open, it may do a great

deal of damage to the jaws and teeth; if the jaws are tightly closed at the time the force is much less apparent. The cross is a lateral blow which lands on the ascending ramus and does its greatest harm to that bone and the temporomaxillary joint; as with the upper cut the effects are much worse if the mouth is open at the time. The hook is a lateral blow like the cross but otherwise resembles the upper cut and may be directed anywhere. There is also the straight arm blow to the chin, one directed against the mouth, and of course others directed against the upper part of the face which are not mentioned here because they mean nothing to the dentist. The five blows already indicated may do great damage to the jaws, teeth and temporomaxillary articulation. To minimize such undesirable effects—which on rare occasions include fracture of the skull and death—the author has devised his intermaxillary protective apparatus, a sort of shock absorber which faintly recalls the rubber worn by the old-time baseball catcher before the introduction of the mask. A soft rubber attachment in front is intended to prevent the cutting of the lips by the teeth; this is continuous behind with the interdental portion which takes the shock from severe blows on the chin, jaw, etc. The device is worn by the local Italian boxers with satisfaction, but apparently it is still in the experimental stage. It must be adapted to the dentition of the individual boxer including of course the edentulous one.

Prophylactic Odontotomy. J. Tellier and P. Beyssac (Lyons). La Revue de Stomatologie, February, 1925, xxvii, 12.

The authors refer especially to the papers published by Hyatt of the U. S. during 1923 and 1924, a digest of which is given. It is not necessary to accept all of the conclusions of the latter and Hyatt's views have opponents as well as partisans. Among the last named are Leon Williams and Darby. Kirk objects to the indiscriminate use of the method which will be abused by the undesirable element among the dentists and cites the fact that a similar procedure recommended many years ago by Arthur led to much abuse. This was in 1867 and again in 1891 the same ill results followed the counsel of Black who sought to anticipate caries. As for the absolute merit of Hyatt's idea Kirk lends a partial adhesion to it, and like a number of other recent writers he would restrict odontotomy in sound teeth to certain premolars and molars. Ottolengui would not interfere in the fissures of the obturating surfaces unless caries had actually started. Rhein believes that while the fissures are readily prepared for filling, filling itself is a problem and only gold inlays are suitable.

The history of the idea in France goes back to Andrieu's "anticipatory resection" in 1885. Whether the idea was carried out in practice does not appear. At any rate nothing more is said of it until in 1910 Léger-Dorez suggested it in the interest of saving the six year molars. Apparently nothing has been done in France to test the efficacy of Hyatt's teaching. Fichot, president of the French Stomatological Society, frankly admitted in the discussion that the field thus opened up had been unsuspected by him. He did not think, however, that it would be a success in France, where the thrifty inhabitants would not be inclined to meet trouble half way.

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EDITORIALS

Does the Dental Profession Desire Reciprocity?

A RECIPROCAL agreement between all of the states has been discussed for a number of years. Just now we find some of the dental journals devoting considerable space to this question. The interchange of licenses has been before the House of Delegates of the American Dental Association for the past three years. At the present time a special committee, appointed by the House of Delegates, has the matter under consideration.

Reciprocity has also been a vital question before the National Association of Dental Examiners. In fact, reciprocal arrangements have been made between certain states and are still in force between a few states. The national interchange of licenses is the object sought by the committee appointed by the A. D. A.

In discussing the national interchange of licenses in the practice of den-

tistry between various states, we are confronted with several problems that will be difficult to solve. The first is that the police power of each state is supreme. Any state can make laws to regulate the action of its own citizens, providing these laws do not conflict with the laws of the national government. Regulation of the practice of dentistry falls within the police power of each state. Certain states have set up standards for the practice of dentistry that are different from those required in some other state.

Whether or not these individual standards have resulted in a better service being rendered to the inhabitants is an open question. These individual standards, however, offer a restricting and prohibiting influence against the national interchange of licenses. Unfortunately laws of individual requirement, which have been enacted by different states, do not always improve the practice of dentistry, but such restrictions and regulations can be used as an argument against the national interchange of licenses. Again, we find certain states refusing to consider a reciprocity agreement with other states, because the dental profession of certain states desires to keep men from being licensed to practice dentistry within their state. It has long been recognized that certain states have been opposed to reciprocal agreements for "climatic reasons." We find "climatic conditions" playing a great part in the reciprocal question, even though this claim may appear to be trivial. Florida made reciprocal arrangements with certain states. These arrangements were made before the favorable "climatic conditions" of Florida had been realized, at a time when it was difficult to get dentists to go to Florida. Within the last two or three years the "climatic conditions" of Florida have been featured, with a result that both medical and dental men are rushing to Florida in large numbers for the purpose of obtaining a license. Things have recently occurred which indicate that the dental profession of Florida would like to break the reciprocal agreements which they had made with other states. These facts simply go to prove that the entire question of reciprocity is not a national problem but one which must be handled by the dental profession in each state.

At the present time we do not believe the dental profession as a whole is interested in the question of national reciprocity. About the only men interested in reciprocity are those who have been forced to change their location and have been subjected to the inconveniences of passing a state board examination. As I know from personal experience, they feel the unfairness of being compelled to pass an examination in order to be licensed to practice in another state, when, in the majority of cases, the examination is not given with the idea of obtaining a man's fitness to practice his profession but with the view of preventing him from obtaining a license. The statement has often been made that members of State Board are very often unable to pass their own examination, and many things which we have seen would tend to substantiate that fact. Another group of men interested in national reciprocity are those who desire to change their location and realize the state board examination would not only be inconvenient to them, but some of them, who have not kept up with the later ideas of the profession, might consequently be unable to pass the examination. About 95 per cent of the profession are not interested in the least, in the question of reciprocity, as they are located

and do not expect to change their location. Most of them are selfishly inclined and would like to prevent anyone else from locating in their community. It is the action of the 95 per cent which prevents national reciprocity from being an actuality, as it is in the medical profession.

The medical profession has a National Board of Examiners, controlled to a certain extent by the Public Health Department of the United States Government. In fact, it was principally through the influence of the Public Health Service that the National Board of Examiners was started. The man who possesses a license granted by the National Board of Examiners is recognized in practically all of the states. This arrangement, however, was brought about through the activity of the American Medical Association and the United States Public Health Service. Both bodies knew the fairness of such recognition of a national license.

One reason the dental profession has failed to recognize the value of national reciprocity is because the dental profession does not have a service similar to the Public Health Service of the United States Government. If there ever comes a time when it is necessary for certain men in the dental profession to render service in different states as the Public Health Service does the dental profession will be more inclined to recognize the value of a national reciprocity agreement.

At the present time there are two great factors that prevent national dental reciprocity from being recognized; the first is that each state has the supreme right to regulate the practice of dentistry within its boundaries; and second, the majority of the dental profession do not want national reciprocity.

ORTHODONTIC NEWS AND NOTES

Seventh International Dental Congress
Philadelphia, August 23-27, 1926

Nearly a quarter of a century has passed since an International Dental Congress was held in this country. This fact signalizes for the profession in America the Seventh International Dental Congress, which meets in Philadelphia August 23 to 27 next, inclusive. The last International Congress held in America was in St. Louis in 1904—twenty-two years ago.

But not for that reason alone is the forthcoming Congress so momentous. The gathering of the dental profession of the world in this country is, it is true, highly important and a source of the keenest interest and greatest pride to the profession on this side of the world.

Nor is it due to the fact that the Sixth Congress, which convened in London in 1914, was adjourned somewhat precipately by the outbreak of the World War, practically in the midst of its deliberations.

The outstanding distinction of the approaching Congress is that the period since the St. Louis session, twenty-two years ago, has been the most notable in development the science and art of dentistry has ever known. The Philadelphia convention will be the climax of a great quarter-century of dental progress.

The Congress will be writ large in dental history. It will live forever in what it achieves in the advancement in professional knowledge and practice.

To the fifteen to twenty thousand dentists who will attend, from all over the world, it will be vivid in memory. They will participate in occurrences that will be monumental to the profession. They will foregather with their confréres of this and other countries, among whom will be the leaders in science and practice in the profession.

To describe the approaching Congress as an epochal event cannot be laid to over-exuberance. A new era in dentistry will no doubt date from this conclave.

The Congress will, by its demonstration of the achievement of the last decade, establish dentistry more firmly than ever as a healing art and will witness its recognition therein by the medical profession and the public.

The Congress will mark the creation of closer bonds of relationship and cooperation between the medical and dental professions. The demonstration by scientific and clinical research of both dental and medical professions that unhygienic and unhealthy conditions of the mouth and teeth have direct bearing upon the bodily health will be celebrated at this Congress.

The Congress will celebrate the eradication from the public mind of the

idea that the practice of dentistry is merely a mechanical art. It will celebrate the enormous development of the Oral Hygiene movement, by which the general health of the school child, the industrial worker, the Army and Navy, and, in fact, every man and woman, is preserved by preventive treatment administered by the dentist. The United States Government's recognition of the value and necessity of such preventive treatment, through its enrollment of 10,000 dental surgeons in the late war for the preventive care of the American Expeditionary Force, will be signalized. Industry's enrollment of dental surgeons to make the workers fitter for their productive tasks will also be celebrated.

The humanitarian service dentistry is rendering by its prevention of bodily disease and the elimination of economic waste will be commended by persons outside the dental profession, such as medical men, business men, sociologists, officials, etc.

The foremost men and women—scientists and practitioners—will be gathered at this most notable Congress. The leaders in both hemispheres will participate. Papers will be read that will set new marks in dental knowledge. Clinics of equal importance will be held. Exhibits of methods, materials and equipment will be lavish and unsurpassed.

The International Dental Congress will be held during an international exposition of arts, sciences, education and social and commercial progress.

Philadelphia, the birthplace of the American republic, is holding this summer the Sesqui-Centennial Celebration and International Exposition in commemoration of the one hundred and fiftieth anniversary of the signing of the Declaration of Independence. In this celebration the national government is joining and the individual states are very largely participating. Many foreign governments will also participate with exhibits, etc.

The dentists attending the Congress, who will be of themselves a cosmopolitan gathering, will be among the multitude assembled from all parts of the globe to attend the Sesqui-Centennial International Exposition.

The Dental Congress will have its own exposition features. There will be shown, in immediate conjunction with the sessions of the Congress, a dental scientific exhibit of large proportions and momentous import. There will be a historical exhibit, displaying the inception and increase of dental knowledge from the earliest practice to the present.

Although the Seventh International Dental Congress will be held in the exposition city, the sessions of the Congress and its exhibits will not be on the exposition grounds. A spacious assembly building, in a different section of the city but equally as near the central point, will be utilized. This is the Commercial Museum, one of the largest and best equipped convention halls in the country.

Every dental practitioner who can should come to Philadelphia in August, 1926. Advantageous railroad rates from all parts of the country are available. Ample accommodations for all are assured if reservations are made in time. An active committee of arrangements of the Philadelphia profession has this in its care.

The first action of those who contemplate attending should be to make

reservations for hotel or other housing accommodations. This can be done by communicating direct with the Philadelphia hotels. The dental journals are publishing lists of hotels and other facilities for accommodation during the Congress. These should be consulted.

It is of the utmost importance that every dentist who has the slightest intention of attending the Congress should at once communicate with the management of one of the Philadelphia hotels or other housing agency and make reservations.

It should be borne in mind that more advantageous rates and better accommodations can be obtained in the hotels, owing to their crowded condition at the time of the Congress, by couples or parties. Dentists contemplating attending unaccompanied by families would do well to arrange with other dentists for parties in securing hotel rooming accommodations.

PUBLICITY COMMITTEE.

LIST OF HOTELS

The Local committee on Hotels urges all who wish to attend the Congress to make Hotel reservations at once. There will be several other large conventions in Philadelphia at that time and immediate action is necessary in order to secure accommodations. Make application direct to hotel.

There will be available for advanced registration of the delegates to the International Dental Congress in Philadelphia during the week of August 23 to 27, 1926, hotel accommodations as follows:

Hotel	Capacity persons	Rate per room per day
BELLEVUE-STRATFORD, S. W. Cor. Broad and Walnut Sts. ..	800 to 1000	$4.00 to $8.00
RITZ-CARLTON, S. E. Cor. Broad and Walnut Sts.	150	7.50
WALTON, Broad and Locust Sts.	400	4.00 to 6.00
STENTON, Broad and Spruce Sts.	50	5.00
THE SPRUCE, 13th and Spruce Sts.	200	4.00 to 6.00
SYLVANIA, Locust and Juniper Sts.	400 to 500	5.00 to 6.00
VENDIG, 13th and Filbert Sts.	300	3.50 to 4.00
WINDSOR, 1219-29 Filbert St.	200 to 300	4.00 to 5.00
HANOVER, N. W. Cor. 12th and Arch Sts.	200 to 300	4.00 to 5.00
ADELPHIA, 13th and Chestnut Sts. (*all rooms with bath*)..	600	4.00 to 5.00
ST. JAMES, 13th and Walnut Sts.	300 to 400	4.00
ALDINE, 19th and Chestnut Sts.	100	4.00 to 5.00
ELK CLUB, Broad and Wood Sts. (*Men only.*)	100	4.00
LORRAINE, Broad St. and Fairmount Ave.	250	3.00 to 6.00
MAJESTIC, Broad St. and Girard Ave.	200	3.00 to 6.00
PENNSYLVANIA, 39th and Chestnut Sts.	400	2.50 to 3.00
GREEN HILL FARMS, City Line and Lancaster Pike	40 to 50	5.00 to 6.00
BARTRAM, 33d and Chestnut Sts.	250	3.00
ROBERT MORRIS, 17th and Arch Sts.	250	3.50 to 4.00
BELGRAVIA, 1801 Chestnut St.	70	3.50 to 9.00
CLINTON APTS., 10th St., below Spruce St.	100	4.00 to 5.00
STRATHMORE, 12th and Walnut Sts.	90	2.50 to 3.00
MARLYN APTS., 40th and Walnut Sts.	20	4.00 to 5.00
WASHINGTON, 7th and Dauphin Sts.	300	3.50
PENN ATHLETIC CLUB, 18th St. and Rittenhouse Square. (*Men only.*)	150	3.50 to 4.50
GIRARD CRAFTSMEN CLUB, 2027 Chestnut St. (*Men only.*)..	25	5.00 to 9.00
Y. M. C. A., 1425 Arch St. (*Men only.*)	50 to 100	1.50 to 2.50
Y. W. C. A., 18th and Arch Sts. (*Women only.*)	25	1.00 to 1.50
WALT WHITMAN, Broadway and Cooper St., Camden, N. J.	100	3.50 to 4.00
PHILADELPHIA YOUNG FRIENDS' ASSOCIATION, INC., Fifteenth and Cherry Sts.	20	4.00 to 4.50

APARTMENTS

The following apartment houses have accommodation for a limited number at prices ranging from $10 and $20 per person per week.

3935 Baltimore Ave., C. Cox.
4218 Baltimore Ave., E. Esnard.
3331 Chestnut St., J. J. Boyle.
3338 Chestnut St., E. Krakow. Apartments for women.
4526 Sansom St., J. H. Newkirk.
3706 Spruce St., C. B. Marriott.
4818 Trinity Place. F. M. Millbourne.
3805 Walnut St., E. N. Simpson
4311 Walnut St., P. A. Cortsen.
5126 Walnut St., J. B. McMillan.
5239 Walton Ave., M. E. Bussom.
108 S. 36th St., F. M. Katar.
330 S. 42nd St., M. C. Lowrie.
323 S. 46th St., H. V. Bechtold.
906 S. 46th St., D. Mackenzie.
1005 S. 49th St., F. Buckley.

W. C. T. BAUERLE, *Chairman*,
Local Committee on Hotels.
Flanders Bldg., Philadelphia, Pa.

UNIVERSITY DORMITORIES

The University of Pennsylvania student dormitories have been placed at the disposal of the Congress members and will accommodate 1000 delegates. Only men can be housed in these dormitories, and dentists desiring these accommodations will bear in mind that they do not equal hotel rooms. Each room will be completely furnished, clean and comfortable, with telephone and other service, and will accommodate from two to six persons. These rooms are excellent for bachelor delegates, or those contemplating coming without families or for parties of men. The University dormitories are within five minutes' walk of the convention hall and ten minutes' car ride from the center of the city.

The rate per day for all rooms will be $2.00 per person. Reservations can be made by applying to Sparta Fritz, Jr., Bursar, 207 S. 36th Street, Philadelphia, Pa.

MAIL THIS APPLICATION DIRECT TO HOTEL

HOTEL RESERVATION

Seventh International Dental Congress, Philadelphia, Pa., August 23 to 27, 1926

.....Hotel. .....1926.
Philadelphia, Pa.

Please reserve accommodations noted below, beginning August..... *to August* .....

.....Room (s) with bath for.....people. Rate desired $.....
(per day)

.....Room (s) without bath for.....people. Rate desired $.....
(per day)

List names and addresses of all who will occupy the room with you.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

Name ..... Address .....
Street, City and State.

Name .....
Street .....
City ..... State.....

First International Orthodontic Congress

The First International Orthodontic Congress will be held at the Hotel Commodore, New York City, August 16 to 20, 1926.

Membership blanks and further information can be obtained by writing to Dr. William C. Fisher, President General, 501 Fifth Ave., New York, N. Y., or Dr. Walter Ellis, Secretary General, 397 Delaware Avenue, Buffalo, N. Y.

Southwestern Society of Orthodontists

The 1926 Session of the Southwestern Society of Orthodontists meets in Houston, Texas, July 31 to August 3, 1926. Following the meeting the majority of members accompanied by their wives will attend the International Orthodontic Congress in New York, and the International Dental Congress at Philadelphia. The party will leave New Orleans by boat, August 4. The Officers of the Society are extremely anxious to make this trip one of both pleasure and profit, and we invite all their orthodontic and dental friends to join us. Extremely low summer rates have been obtained provided round-trip tickets are purchased. Those in central and western states can go to Houston and by boat to New York and return home over any route. A number will motor to Houston, ship their cars to New York and motor home from New York. The freight boat rate for cars Galveston to New York will be $1.38 per hundred lbs. This will make an ideal short summer vacation trip. A two days' stopover in Havana is also being contemplated. The Houston program and the meetings on the boat will be worth while. To secure boat reservations it is necessary that some arrangements be made NOW. Those contemplating making the trip should write at once for additional information.—P. G. Spencer, Secretary, Amicable Bldg., Waco, Texas.

Tennessee State Dental Association

The Fifty-ninth Annual Meeting of the Tennessee State Dental Association will be held at Nashville, Tenn., May 4-7, 1926.—J. B. Jones, Secretary.

The Dental Society of the State of New York—Preliminary Program

The fifty-eighth annual meeting of the Dental Society of the State of New York will be held at the Hotel Astor, New York City, May 19, 20, 21 and 22, 1926.

The literary exercises, clinics and exhibits will be held at the Hotel Astor. Dr. A. C. Bennett, 576 Fifth Avenue, New York City, is chairman of the Exhibits Committee, and those desiring space should communicate with him immediately. Dr. Frederick R. Adams, 8 West 40th Street, New York City, is chairman of the Clinic Committee.

The Executive Council will convene for the transaction of the business of the Society at 10:00 A.M., Wednesday, May 19.

Educational courses will be given on May 17, 18 and 19, prior to the regular session of the State Society. Applications for registration in courses one and two, Extraction and Anesthesia, should be made to Dr. Adolph Berger, 10 East 74th Street, New York City. Applications for the other clinical courses, consisting of Root Canal Therapy, Radiography, Dental Ceramics, Shoulder Crowns, The Use of Porcelain, Removable Bridgework, Movable Removable Bridgework, Dental Anatomy, Fixed Bridgework, Various Technics Essential to Bridgework, Full Denture Construction, Partial Denture Construction, The Treatment of Periodontoclasia and Orthodontia, should be made to Dr. Edward Kennedy, 347 Fifth Avenue, New York City. Full information with reference to these courses will be furnished on application. A cordial invitation is extended to the members of other State Societies to avail themselves of the opportunity to take these educational courses.

LITERARY PROGRAM

MAY 19, 20, 21 AND 22, 1926

A New Research on Dental Caries.
By Dr. Percy R. Howe, Boston, Mass.

Interpretation of Pains about the Head.
By Dr. Frederick B. Morehead, Chicago, Ill.

Some Common Diseases of the Oral Mucous Membrane and the Tongue.
By Dr. Hermann Prinz, Philadelphia, Pa.

Rehabilitation of the Mouth with Gold.
By Dr. Arthur G. Smith, Peoria, Ill.

Research Commission Report.

Cure of Focal Infections.
By Dr. M. L. Rhein, New York City.

Removable Bridgework, Showing Some New Devices and New Arrangements of Old Devices.
By Dr. Charles F. Ash, New York City.

Indications for and Limitations of Alveolectomy.
By Dr. Victor Sears, New York City.

Indications for and Limitations of Apicoectomy.
By Dr. Adolph Berger, New York City.

Correction of Maxillary and Palatal Defects Preparatory to Prosthetic Restoration.
Dr. Harold S. Vaughan, New York City.

Prosthetic Restoration After Surgical Treatment, War Time Work (Lantern Slides).
By Dr. Joseph D. Eby, New York City.

Prosthetic Restoration After Surgical Treatment, Peace Time Work (Lantern Slides).
By Dr. Edward Kennedy, New York City.

There will be an Oral Health Dinner at the Hotel Astor during the meeting of the Society. It is expected that there will be many most attractive features in connection with this dinner. Prominent public officials are expected to be present and the addresses and demonstrations will be of the very highest order.

During the time of the meeting of the New York State Dental Society, sessions of the New York State Dental Hygienists Association and the Dental Assistants Association will be held.

Every effort is being put forth to make this meeting one of the most attractive in the history of the Society. Reduced railroad rates have been secured for this meeting.

A cordial invitation is extended to all ethical practitioners. Admission to the literary meetings and clinics may be secured by registering and presenting membership cards in the State or National Societies. Headquarters will be at the Hotel Astor and reservations should be made direct with the hotel management. For further information and programs address A. P. Burkhart, Secretary, 57 East Genesee Street, Auburn, N. Y.

Ontario Dental Association

The Annual Convention of the Ontario Dental Association will be held at the King Edward Hotel, Toronto, May 17, 18, 19, and 20, 1926. An excellent practical program has been arranged. Dentists from points outside Ontario are cordially invited.

Notes of Interest

Dr. V. R. Shriner desires to announce that he has taken over the offices and assumed the orthodontic practice of the late Dr. Wilson Foster, 744 Doctors Building, Cincinnati, Ohio.